

WHAT IS CLAIMED IS:

1. A human interleukin-3 mutant polypeptide  
Formula I:

5 Ala Pro Met Thr Gln Thr Thr Ser Leu Lys Thr Ser Trp Val Asn  
1 5 10 15

Cys Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa  
20 25 30

10 Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa  
35 40 45

Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa  
15 50 55 60

Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa  
65 70 75

20 Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa  
80 85 90

Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa  
95 100 105

25 Xaa Phe Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa  
110 115 120

Xaa Xaa Xaa Gln Gln Thr Thr Leu Ser Leu Ala Ile Phe [SEQ ID  
30 125 130

NO:15)

35 wherein Xaa at position 17 is Ser, Lys, Gly, Asp, Met, Gln, or  
Arg;  
Xaa at position 18 is Asn, His, Leu, Ile, Phe, Arg, or Gln;  
Xaa at position 19 is Met, Phe, Ile, Arg, Gly, Ala, or Cys;

- Xaa at position 20 is Ile, Cys, Gln, Glu, Arg, Pro, or Ala;  
Xaa at position 21 is Asp, Phe, Lys, Arg, Ala, Gly, Glu, Gln, Asn,  
Thr, Ser or  
Val;
- 5 Xaa at position 22 is Glu, Trp, Pro, Ser, Ala, His, Asp, Asn, Gln,  
Leu, Val or  
Gly;
- Xaa at position 23 is Ile, Val, Ala, Leu, Gly, Trp, Lys, Phe,  
Leu, Ser, or Arg;
- 10 Xaa at position 24 is Ile, Gly, Val, Arg, Ser, Phe, or Leu;  
Xaa at position 25 is Thr, His, Gly, Gln, Arg, Pro, or Ala;  
Xaa at position 26 is His, Thr, Phe, Gly, Arg, Ala, or Trp;  
Xaa at position 27 is Leu, Gly, Arg, Thr, Ser, or Ala;  
Xaa at position 28 is Lys, Arg, Leu, Gln, Gly, Pro, Val or Trp;
- 15 Xaa at position 29 is Gln, Asn, Leu, Pro, Arg, or Val;  
Xaa at position 30 is Pro, His, Thr, Gly, Asp, Gln, Ser, Leu, or  
Lys;
- Xaa at position 31 is Pro, Asp, Gly, Ala, Arg, Leu, or Gln;  
Xaa at position 32 is Leu, Val, Arg, Gln, Asn, Gly, Ala, or Glu;
- 20 Xaa at position 33 is Pro, Leu, Gln, Ala, Thr, or Glu;  
Xaa at position 34 is Leu, Val, Gly, Ser, Lys, Glu, Gln, Thr, Arg,  
Ala, Phe,  
Ile or Met;
- Xaa at position 35 is Leu, Ala, Gly, Asn, Pro, Gln, or Val;
- 25 Xaa at position 36 is Asp, Leu, or Val;  
Xaa at position 37 is Phe, Ser, Pro, Trp, or Ile;  
Xaa at position 38 is Asn, or Ala;  
Xaa at position 40 is Leu, Trp, or Arg;  
Xaa at position 41 is Asn, Cys, Arg, Leu, His, Met, or Pro;
- 30 Xaa at position 42 is Gly, Asp, Ser, Cys, Asn, Lys, Thr, Leu, Val,  
Glu, Phe,  
Tyr, Ile, Met or Ala;
- Xaa at position 43 is Glu, Asn, Tyr, Leu, Phe, Asp, Ala, Cys, Gln,  
Arg, Thr,
- 35 Gly or Ser;
- Xaa at position 44 is Asp, Ser, Leu, Arg, Lys, Thr, Met, Trp, Glu,  
Asn, Gln,

- Ala or Pro;
- Xaa at position 45 is Gln, Pro, Phe, Val, Met, Leu, Thr, Lys, Trp, Asp, Asn,
- Arg, Ser, Ala, Ile, Glu or His;
- 5 Xaa at position 46 is Asp, Phe, Ser, Thr, Cys, Glu, Asn, Gln, Lys, His, Ala,
- Tyr, Ile, Val or Gly;
- Xaa at position 47 is Ile, Gly, Val, Ser, Arg, Pro, or His;
- Xaa at position 48 is Leu, Ser, Cys, Arg, Ile, His, Phe, Glu, Lys,
- 10 Thr, Ala,
- Met, Val or Asn;
- Xaa at position 49 is Met, Arg, Ala, Gly, Pro, Asn, His, or Asp;
- Xaa at position 50 is Glu, Leu, Thr, Asp, Tyr, Lys, Asn, Ser, Ala, Ile, Val,
- 15 His, Phe, Met or Gln;
- Xaa at position 51 is Asn, Arg, Met, Pro, Ser, Thr, or His;
- Xaa at position 52 is Asn, His, Arg, Leu, Gly, Ser, or Thr;
- Xaa at position 53 is Leu, Thr, Ala, Gly, Glu, Pro, Lys, Ser, or Met;
- 20 Xaa at position 54 is Arg, Asp, Ile, Ser, Val, Thr, Gln, Asn, Lys, His, Ala or Leu;
- Xaa at position 55 is Arg, Thr, Val, Ser, Leu, or Gly;
- Xaa at position 56 is Pro, Gly, Cys, Ser, Gln, Glu, Arg, His, Thr, Ala, Tyr, Phe, Leu, Val or Lys;
- 25 Xaa at position 57 is Asn or Gly;
- Xaa at position 58 is Leu, Ser, Asp, Arg, Gln, Val, or Cys;
- Xaa at position 59 is Glu Tyr, His, Leu, Pro, or Arg;
- Xaa at position 60 is Ala, Ser, Pro, Tyr, Asn, or Thr;
- Xaa at position 61 is Phe, Asn, Glu, Pro, Lys, Arg, or Ser;
- 30 Xaa at position 62 is Asn His, Val, Arg, Pro, Thr, Asp, or Ile;
- Xaa at position 63 is Arg, Tyr, Trp, Lys, Ser, His, Pro, or Val;
- Xaa at position 64 is Ala, Asn, Pro, Ser, or Lys;
- Xaa at position 65 is Val, Thr, Pro, His, Leu, Phe, or Ser;
- Xaa at position 66 is Lys, Ile, Arg, Val, Asn, Glu, or Ser;
- 35 Xaa at position 67 is Ser, Ala, Phe, Val, Gly, Asn, Ile, Pro, or His;
- Xaa at position 68 is Leu, Val, Trp, Ser, Ile, Phe, Thr, or His;

- Xaa at position 69 is Gln, Ala, Pro, Thr, Glu, Arg, Trp, Gly, or Leu;
- Xaa at position 70 is Asn, Leu, Val, Trp, Pro, or Ala;
- Xaa at position 71 is Ala, Met, Leu, Pro, Arg, Glu, Thr, Gln, Trp, or Asn;
- Xaa at position 72 is Ser, Glu, Met, Ala, His, Asn, Arg, or Asp;
- Xaa at position 73 is Ala, Glu, Asp, Leu, Ser, Gly, Thr, or Arg;
- Xaa at position 74 is Ile, Met, Thr, Pro, Arg, Gly, Ala;
- Xaa at position 75 is Glu, Lys, Gly, Asp, Pro, Trp, Arg, Ser, Gln, or Leu;
- Xaa at position 76 is Ser, Val, Ala, Asn, Trp, Glu, Pro, Gly, or Asp;
- Xaa at position 77 is Ile, Ser, Arg, Thr, or Leu;
- Xaa at position 78 is Leu, Ala, Ser, Glu, Phe, Gly, or Arg;
- Xaa at position 79 is Lys, Thr, Asn, Met, Arg, Ile, Gly, or Asp;
- Xaa at position 80 is Asn, Trp, Val, Gly, Thr, Leu, Glu, or Arg;
- Xaa at position 81 is Leu, Gln, Gly, Ala, Trp, Arg, Val, or Lys;
- Xaa at position 82 is Leu, Gln, Lys, Trp, Arg, Asp, Glu, Asn, His, Thr, Ser, Ala, Tyr, Phe, Ile, Met or Val;
- Xaa at position 83 is Pro, Ala, Thr, Trp, Arg, or Met;
- Xaa at position 84 is Cys, Glu, Gly, Arg, Met, or Val;
- Xaa at position 85 is Leu, Asn, Val, or Gln;
- Xaa at position 86 is Pro, Cys, Arg, Ala, or Lys;
- Xaa at position 87 is Leu, Ser, Trp, or Gly;
- Xaa at position 88 is Ala, Lys, Arg, Val, or Trp;
- Xaa at position 89 is Thr, Asp, Cys, Leu, Val, Glu, His, Asn, or Ser;
- Xaa at position 90 is Ala, Pro, Ser, Thr, Gly, Asp, Ile, or Met;
- Xaa at position 91 is Ala, Pro, Ser, Thr, Phe, Leu, Asp, or His;
- Xaa at position 92 is Pro, Phe, Arg, Ser, Lys, His, Ala, Gly, Ile or Leu;
- Xaa at position 93 is Thr, Asp, Ser, Asn, Pro, Ala, Leu, or Arg;
- Xaa at position 94 is Arg, Ile, Ser, Glu, Leu, Val, Gln, Lys, His, Ala, or Pro;
- Xaa at position 95 is His, Gln, Pro, Arg, Val, Leu, Gly, Thr, Asn,

- Lys, Ser,  
     Ala, Trp, Phe, Ile, or Tyr;  
 Xaa at position 96 is Pro, Lys, Tyr, Gly, Ile, or Thr;  
 Xaa at position 97 is Ile, Val, Lys, Ala, or Asn;  
 5   Xaa at position 98 is His, Ile, Asn, Leu, Asp, Ala, Thr,  
     Glu, Gln, Ser, Phe, Met, Val, Lys, Arg, Tyr or Pro;  
 Xaa at position 99 is Ile, Leu, Arg, Asp, Val, Pro, Gln,  
     Gly, Ser, Phe, or His;  
 Xaa at position 100 is Lys, Tyr, Leu, His, Arg, Ile, Ser, Gln,  
 10   or Pro;  
 Xaa at position 101 is Asp, Pro, Met, Lys, His, Thr, Val,  
     Tyr, Glu, Asn, Ser, Ala, Gly, Ile, Leu, or Gln;  
 Xaa at position 102 is Gly, Leu, Glu, Lys, Ser, Tyr, or Pro;  
 Xaa at position 103 is Asp, or Ser;  
 15   Xaa at position 104 is Trp, Val, Cys, Tyr, Thr, Met, Pro, Leu,  
     Gln, Lys, Ala, Phe, or Gly;  
 Xaa at position 105 is Asn, Pro, Ala, Phe, Ser, Trp, Gln, Tyr,  
     Leu, Lys, Ile, Asp, or His;  
 Xaa at position 106 is Glu, Ser, Ala, Lys, Thr, Ile, Gly, or Pro;  
 20   Xaa at position 108 is Arg, Lys, Asp, Leu, Thr, Ile, Gln, His, Ser,  
     Ala or  
     Pro;  
 Xaa at position 109 is Arg, Thr, Pro, Glu, Tyr, Leu, Ser, or Gly;  
 Xaa at position 110 is Lys, Ala, Asn, Thr, Leu, Arg, Gln, His, Glu,  
 25   Ser, Ala,  
     or Trp;  
 Xaa at position 111 is Leu, Ile, Arg, Asp, or Met;  
 Xaa at position 112 is Thr, Val, Gln, Tyr, Glu, His, Ser, or Phe;  
 Xaa at position 113 is Phe, Ser, Cys, His, Gly, Trp, Tyr, Asp,  
 30   Lys, Leu, Ile, Val or Asn;  
 Xaa at position 114 is Tyr, Cys, His, Ser, Trp, Arg, or Leu;  
 Xaa at position 115 is Leu, Asn, Val, Pro, Arg, Ala, His, Thr,  
     Trp, or Met;  
 Xaa at position 116 is Lys, Leu, Pro, Thr, Met, Asp, Val, Glu,  
 35   Arg, Trp, Ser, Asn, His, Ala, Tyr, Phe, Gln, or Ile;  
 Xaa at position 117 is Thr, Ser, Asn, Ile, Trp, Lys, or Pro;  
 Xaa at position 118 is Leu, Ser, Pro, Ala, Glu, Cys, Asp, or Tyr;

Xaa at position 119 is Glu, Ser, Lys, Pro, Leu, Thr, Tyr, or Arg;  
 Xaa at position 120 is Asn, Ala, Pro, Leu, His, Val, or Gln;  
 Xaa at position 121 is Ala, Ser, Ile, Asn, Pro, Lys, Asp, or  
 Gly;

5 Xaa at position 122 is Gln, Ser, Met, Trp, Arg, Phe, Pro, His,  
 Ile, Tyr, or Cys;

Xaa at position 123 is Ala, Met, Glu, His, Ser, Pro, Tyr, or Leu;

10 and which can additionally have Met- preceding the amino acid in  
 position 1; and wherein from 1 to 14 amino acids can be deleted  
 from the N-terminus and/or from 1 to 15 amino acids can be deleted  
 from the C-terminus; and wherein from 4 to 44 of the amino acids  
 designated by Xaa are different from the corresponding amino acids  
 of native (1-133) human interleukin-3.

15

2. A human interleukin-3 mutant polypeptide of the  
 Formula II:

20 Ala Pro Met Thr Gln Thr Thr Ser Leu Lys Thr Ser Trp Val Asn  
     1          5    10                  15

Cys Xaa Xaa Xaa Xaa Xaa Glu Xaa Xaa Xaa Xaa Leu Xaa Xaa Xaa  
           20    25                  30

25 Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Asn Leu Xaa Xaa Glu Xaa Xaa  
           35    40                  45

Xaa Xaa Leu Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Asn Leu Xaa Xaa  
 30          50    55                  60

Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa  
           65    70                  75

35 Xaa Xaa Leu Xaa Xaa Xaa Xaa Xaa Cys Xaa Pro Xaa Xaa Xaa Xaa  
           80    85                  90

Xaa Xaa Xaa Arg Xaa Xaa Xaa Xaa Xaa Xaa Xaa Asp Xaa Xaa  
 95 100 105

5 Xaa Phe Xaa Xaa Lys Leu Xaa Phe Xaa Xaa Xaa Xaa Leu Xaa Xaa  
 110 115 120  
 Xaa Xaa Xaa Gln Gln Thr Thr Leu Ser Leu Ala Ile Phe [SEQ ID NO:16]  
 125 130

wherein

- 10 Xaa at position 17 is Ser, Gly, Asp, Met, or Gln;  
 Xaa at position 18 is Asn, His, Leu, Ile, Phe, Arg, or Gln;  
 Xaa at position 19 is Met, Phe, Ile, Arg, or Ala;  
 Xaa at position 20 is Ile or Pro;  
 Xaa at position 21 is Asp or Glu;
- 15 Xaa at position 23 is Ile, Val, Ala, Leu, or Gly;  
 Xaa at position 24 is Ile, Val, Phe, or Leu;  
 Xaa at position 25 is Thr, His, Gly, Gln, Arg, Pro, or Ala;  
 Xaa at position 26 is His, Phe, Gly, Arg, or Ala;  
 Xaa at position 28 is Lys, Leu, Gln, Gly, Pro, or Val;
- 20 Xaa at position 29 is Gln, Asn, Leu, Arg, or Val;  
 Xaa at position 30 is Pro, His, Thr, Gly, or Gln;  
 Xaa at position 31 is Pro, Asp, Gly, Ala, Arg, Leu, or Gln;  
 Xaa at position 32 is Leu, Arg, Gln, Asn, Gly, Ala, or Glu;  
 Xaa at position 33 is Pro, Leu, Gln, Ala, or Glu;
- 25 Xaa at position 34 is Leu, Val, Gly, Ser, Lys, Ala, Arg, Gln, Glu,  
 Ile, Phe, Thr or Met;  
 Xaa at position 35 is Leu, Ala, Asn, Pro, Gln, or Val;  
 Xaa at position 36 is Asp or Leu;  
 Xaa at position 37 is Phe, Ser, Pro, Trp, or Ile;
- 30 Xaa at position 38 is Asn or Ala;  
 Xaa at position 41 is Asn, Cys, Arg, His, Met, or Pro;  
 Xaa at position 42 is Gly, Asp, Ser, Cys, Ala, Asn, Ile, Leu, Met,  
 Tyr, Val or Arg;  
 Xaa at position 44 is Asp or Glu;
- 35 Xaa at position 45 is Gln, Val, Met, Leu, Thr, Lys, Ala, Asn, Glu,  
 Ser, or Trp;  
 Xaa at position 46 is Asp, Phe, Ser, Thr, Cys, Ala, Asn, Gln, Glu,

His, Ile, Lys, Tyr, Val or Gly;

Xaa at position 47 is Ile, Val, or His;

Xaa at position 49 is Met, Asn, or Asp;

Xaa at position 50 is Glu, Thr, Ala, Asn, Ser or Asp;

5 Xaa at position 51 is Asn, Arg, Met, Pro, Ser, Thr, or His;

Xaa at position 52 is Asn or Gly;

Xaa at position 53 is Leu, Met, or Phe;

Xaa at position 54 is Arg, Ala, or Ser;

Xaa at position 55 is Arg, Thr, Val, Leu, or Gly;

10 Xaa at position 56 is Pro, Gly, Cys, Ser, Gln, Ala, Arg, Asn, Glu, His, Leu,

Thr, Val or Lys;

Xaa at position 59 is Glu, Tyr, His, Leu, or Arg;

Xaa at position 60 is Ala, Ser, Asn, or Thr;

15 Xaa at position 61 is Phe or Ser;

Xaa at position 62 is Asn, Val, Pro, Thr, or Ile;

Xaa at position 63 is Arg, Tyr, Lys, Ser, His, or Val;

Xaa at position 64 is Ala or Asn;

Xaa at position 65 is Val, Thr, Leu, or Ser;

20 Xaa at position 66 is Lys, Ile, Arg, Val, Asn, Glu, or Ser;

Xaa at position 67 is Ser, Phe, Val, Gly, Asn, Ile, or His;

Xaa at position 68 is Leu, Val, Ile, Phe, or His;

Xaa at position 69 is Gln, Ala, Pro, Thr, Glu, Arg, or Gly;

Xaa at position 70 is Asn or Pro;

25 Xaa at position 71 is Ala, Met, Pro, Arg, Glu, Thr, or Gln;

Xaa at position 72 is Ser, Glu, Met, Ala, His, Asn, Arg, or Asp;

Xaa at position 73 is Ala, Glu, Asp, Leu, Ser, Gly, Thr, Arg, or Pro;

Xaa at position 74 is Ile or Met;

30 Xaa at position 75 is Glu, Gly, Asp, Ser, or Gln;

Xaa at position 76 is Ser, Val, Ala, Asn, Glu, Pro, Gly, or Asp;

Xaa at position 77 is Ile, Ser, or Leu;

Xaa at position 79 is Lys, Thr, Gly, Asn, Met, Arg, Ile, Gly, or

35 Asp;

Xaa at position 80 is Asn, Val, Gly, Thr, Leu, Glu, or Arg;

Xaa at position 81 is Leu, or Val;



- Xaa at position 82 is Leu, Gln, Trp, Arg, Asp, Ala, Asn, Glu, His,  
Met, Phe, Ser, Thr, Tyr or Val;
- Xaa at position 83 is Pro, Ala, Thr, Trp, or Met;
- Xaa at position 85 is Leu or Val;
- 5 Xaa at position 87 is Leu or Ser;
- Xaa at position 88 is Ala, Arg, or Trp;
- Xaa at position 89 is Thr, Asp, Glu, His, Asn, or Ser;
- Xaa at position 90 is Ala, Asp, or Met;
- Xaa at position 91 is Ala, Pro, Ser, Thr, Phe, Leu, or Asp;
- 10 Xaa at position 92 is Pro or Ser;
- Xaa at position 93 is Thr, Asp, Ser, Pro, Ala, Leu, or Arg;
- Xaa at position 95 is His, Pro, Arg, Val, Leu, Gly, Asn, Ile, Phe,  
Ser or Thr;
- Xaa at position 96 is Pro or Tyr;
- 15 Xaa at position 97 is Ile, Val, or Ala;
- Xaa at position 98 is His, Ile, Asn, Leu, Asp, Ala, Thr, Leu, Arg,  
Gln, Glu,  
Lys, Met, Ser, Tyr, Val or Pro;
- Xaa at position 99 is Ile, Leu, Val, or Phe;
- 20 Xaa at position 100 is Lys, Leu, His, Arg, Ile, Gln, Pro, or  
Ser;
- Xaa at position 101 is Asp, Pro, Met, Lys, His, Thr, Val,  
Asn, Ile, Leu or Tyr;
- Xaa at position 102 is Gly, Glu, Lys, or Ser;
- 25 Xaa at position 104 is Trp, Val, Tyr, Met, or Leu;
- Xaa at position 105 is Asn, Pro, Ala, Phe, Ser, Trp, Gln, Tyr,  
Leu, Lys, Ile, Asp, or His;
- Xaa at position 106 is Glu, Ser, Ala, or Gly;
- Xaa at position 108 is Arg, Ala, Gln, Ser or Lys;
- 30 Xaa at position 109 is Arg, Thr, Glu, Leu, Ser, or Gly;
- Xaa at position 112 is Thr, Val, Gln, Glu, His, or Ser;
- Xaa at position 114 is Tyr or Trp;
- Xaa at position 115 is Leu or Ala;
- Xaa at position 116 is Lys, Thr, Met, Val, Trp, Ser, Leu, Ala, Asn,  
35 Gln, His, Met, Phe, Tyr or Ile;
- Xaa at position 117 is Thr, Ser, or Asn;
- Xaa at position 119 is Glu, Ser, Pro, Leu, Thr, or Tyr;

Xaa at position 120 is Asn, Pro, Leu, His, Val, or Gln;

Xaa at position 121 is Ala, Ser, Ile, Asn, Pro, Lys, Asp, or Gly;

5 Xaa at position 122 is Gln, Ser, Met, Trp, Arg, Phe, Pro, His, Ile, Tyr, or Cys;

Xaa at position 123 is Ala, Met, Glu, His, Ser, Pro, Tyr, or Leu;

10 and which can additionally have Met- preceding the amino acid in position 1; and wherein from 1 to 14 amino acids can be deleted from the N-terminus and/or from 1 to 15 amino acids can be deleted from the C-terminus; and wherein from 4 to 44 of the amino acids designated by Xaa are different from the corresponding amino acids of native (1-133) human interleukin-3.

15 3. A human interleukin-3 mutant polypeptide according to claim 2 of the Formula III:

|    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|    | Ala | Pro | Met | Thr | Gln | Thr | Thr | Ser | Leu | Lys | Thr | Ser | Trp | Val | Asn |
|    | 1   |     |     | 5   | 10  |     |     |     |     | 15  |     |     |     |     |     |
| 20 | Cys | Xaa | Xaa | Xaa | Ile | Xaa | Glu | Xaa | Xaa | Xaa | Xaa | Leu | Lys | Xaa | Xaa |
|    |     |     |     | 20  | 25  |     |     |     |     | 30  |     |     |     |     |     |
|    | Xaa | Xaa | Xaa | Xaa | Xaa | Asp | Xaa | Xaa | Asn | Leu | Asn | Xaa | Glu | Xaa | Xaa |
| 25 |     |     |     | 35  | 40  |     |     |     |     | 45  |     |     |     |     |     |
|    | Xaa | Ile | Leu | Met | Xaa | Xaa | Asn | Leu | Xaa | Xaa | Xaa | Asn | Leu | Glu | Xaa |
|    |     |     |     | 50  | 55  |     |     |     |     | 60  |     |     |     |     |     |
| 30 | Phe | Xaa | Xaa | Xaa | Xaa | Xaa | Xaa | Xaa | Xaa | Asn | Xaa | Xaa | Xaa | Ile | Glu |
|    |     |     |     | 65  | 70  |     |     |     |     | 75  |     |     |     |     |     |
|    | Xaa | Xaa | Leu | Xaa | Xaa | Leu | Xaa | Xaa | Cys | Xaa | Pro | Xaa | Xaa | Thr | Ala |
|    |     |     |     | 80  | 85  |     |     |     |     | 90  |     |     |     |     |     |
| 35 | Xaa | Pro | Xaa | Arg | Xaa | Xaa | Xaa | Xaa | Xaa | Xaa | Xaa | Gly | Asp | Xaa | Xaa |
|    |     |     |     | 95  | 100 |     |     |     |     | 105 |     |     |     |     |     |

Xaa Phe Xaa Xaa Lys Leu Xaa Phe Xaa Xaa Xaa Xaa Leu Glu Xaa  
 110 115 120

5 Xaa Xaa Xaa Gln Gln Thr Thr Leu Ser Leu Ala Ile Phe [SEQ ID NO:17]  
 125 130

wherein

- Xaa at position 17 is Ser, Gly, Asp, Met, or Gln;
- 10 Xaa at position 18 is Asn, His, or Ile;  
 Xaa at position 19 is Met or Ile;  
 Xaa at position 21 is Asp or Glu;  
 Xaa at position 23 is Ile, Ala, Leu, or Gly;  
 Xaa at position 24 is Ile, Val, or Leu;
- 15 Xaa at position 25 is Thr, His, Gln, or Ala;  
 Xaa at position 26 is His or Ala;  
 Xaa at position 29 is Gln, Asn, or Val;  
 Xaa at position 30 is Pro, Gly, or Gln;  
 Xaa at position 31 is Pro, Asp, Gly, or Gln;
- 20 Xaa at position 32 is Leu, Arg, Gln, Asn, Gly, Ala, or Glu;  
 Xaa at position 33 is Pro or Glu;  
 Xaa at position 34 is Leu, Val, Gly, Ser, Lys, Ala, Arg, Gln,  
 Glu, Ile, Phe, Thr or Met;  
 Xaa at position 35 is Leu, Ala, Asn, Pro, Gln, or Val;
- 25 Xaa at position 37 is Phe, Ser, Pro, or Trp;  
 Xaa at position 38 is Asn or Ala;  
 Xaa at position 42 is Gly, Asp, Ser, Cys, Ala, Asn, Ile, Leu,  
 Met, Tyr or Arg;  
 Xaa at position 44 is Asp or Glu;
- 30 Xaa at position 45 is Gln, Val, Met, Leu, Thr, Ala, Asn, Glu,  
 Ser or Lys;  
 Xaa at position 46 is Asp, Phe, Ser, Thr, Ala, Asn Gln, Glu, His,  
 Ile, Lys, Tyr, Val or Cys;  
 Xaa at position 50 is Glu, Ala, Asn, Ser or Asp;
- 35 Xaa at position 51 is Asn, Arg, Met, Pro, Ser, Thr, or His;  
 Xaa at position 54 is Arg or Ala;  
 Xaa at position 55 is Arg, Thr, Val, Leu, or Gly;

- Xaa at position 56 is Pro, Gly, Ser, Gln, Ala, Arg, Asn, Glu,  
Leu, Thr, Val or Lys;
- Xaa at position 60 is Ala or Ser;
- Xaa at position 62 is Asn, Pro, Thr, or Ile;
- 5 Xaa at position 63 is Arg or Lys;
- Xaa at position 64 is Ala or Asn;
- Xaa at position 65 is Val or Thr;
- Xaa at position 66 is Lys or Arg;
- Xaa at position 67 is Ser, Phe, or His;
- 10 Xaa at position 68 is Leu, Ile, Phe, or His;
- Xaa at position 69 is Gln, Ala, Pro, Thr, Glu, Arg, or Gly;
- Xaa at position 71 is Ala, Pro, or Arg;
- Xaa at position 72 is Ser, Glu, Arg, or Asp;
- Xaa at position 73 is Ala or Leu;
- 15 Xaa at position 76 is Ser, Val, Ala, Asn, Glu, Pro, or Gly;
- Xaa at position 77 is Ile or Leu;
- Xaa at position 79 is Lys, Thr, Gly, Asn, Met, Arg, Ile, Gly, or  
Asp;
- Xaa at position 80 is Asn, Gly, Glu, or Arg;
- 20 Xaa at position 82 is Leu, Gln, Trp, Arg, Asp, Ala, Asn, Glu, His,  
Ile, Met, Phe, Ser, Thr, Tyr or Val;
- Xaa at position 83 is Pro or Thr;
- Xaa at position 85 is Leu or Val;
- Xaa at position 87 is Leu or Ser;
- 25 Xaa at position 88 is Ala or Trp;
- Xaa at position 91 is Ala or Pro;
- Xaa at position 93 is Thr, Asp, Ser, Pro, Ala, Leu, or Arg;
- Xaa at position 95 is His, Pro, Arg, Val, Leu, Gly, Asn, Phe, Ser  
or Thr;
- 30 Xaa at position 96 is Pro or Tyr;
- Xaa at position 97 is Ile or Val;
- Xaa at position 98 is His, Ile, Asn, Leu, Ala, Thr, Leu, Arg, Gln,  
Leu, Lys, Met, Ser, Tyr, Val or Pro;
- Xaa at position 99 is Ile, Leu, or Val;
- 35 Xaa at position 100 is Lys, Arg, Ile, Gln, Pro, or Ser;
- Xaa at position 101 is Asp, Pro, Met, Lys, His, Thr, Pro, Asn,  
Ile, Leu or Tyr;

- Xaa at position 104 is Trp or Leu;  
 Xaa at position 105 is Asn, Pro, Ala, Ser, Trp, Gln, Tyr, Leu,  
     Lys, Ile, Asp, or His;  
 Xaa at position 106 is Glu or Gly;  
 5 Xaa at position 108 is Arg, Ala, or Ser;  
 Xaa at position 109 is Arg, Thr, Glu, Leu, or Ser;  
 Xaa at position 112 is Thr, Val, or Gln;  
 Xaa at position 114 is Tyr or Trp;  
 Xaa at position 115 is Leu or Ala;  
 10 Xaa at position 116 is Lys, Thr, Val, Trp, Ser, Ala, His, Met,  
     Phe, Tyr or Ile;  
 Xaa at position 117 is Thr or Ser;  
 Xaa at position 120 is Asn, Pro, Leu, His, Val, or Gln;  
 Xaa at position 121 is Ala, Ser, Ile, Asn, Pro, Asp, or Gly;  
 15 Xaa at position 122 is Gln, Ser, Met, Trp, Arg, Phe, Pro, His,  
     Ile, Tyr, or Cys;  
 Xaa at position 123 is Ala, Met, Glu, His, Ser, Pro, Tyr, or Leu;

- and which can additionally have Met- preceding the amino acid in  
 20 position 1; and wherein from 1 to 14 amino acids can be deleted  
 from the N-terminus and/or from 1 to 15 amino acids can be deleted  
 from the C-terminus; and wherein from 4 to 35 of the amino acids  
 designated by Xaa are different from the corresponding amino acids  
 of native (1-133)human interleukin-3.

25

4. A human interleukin-3 mutant polypeptide according  
 to Claim 3 of the Formula IV:

- |    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|    | Ala | Pro | Met | Thr | Gln | Thr | Thr | Ser | Leu | Lys | Thr | Ser | Trp | Val | Asn |
| 30 | 1   |     |     | 5   | 10  |     |     |     |     | 15  |     |     |     |     |     |
|    | Cys | Xaa | Xaa | Met | Ile | Asp | Glu | Xaa | Ile | Xaa | Xaa | Leu | Lys | Xaa | Xaa |
|    |     |     |     | 20  | 25  |     |     |     |     | 30  |     |     |     |     |     |
| 35 | Pro | Xaa | Pro | Xaa | Xaa | Asp | Phe | Xaa | Asn | Leu | Asn | Xaa | Glu | Asp | Xaa |
|    |     |     |     | 35  | 40  |     |     |     |     | 45  |     |     |     |     |     |

Xaa Ile Leu Met Xaa Xaa Asn Leu Arg Xaa Xaa Asn Leu Glu Ala  
                   50    55                  60  
  
 Phe Xaa Arg Xaa Xaa Lys Xaa Xaa Xaa Asn Ala Ser Ala Ile Glu  
 5                  65    70                  75  
  
 Xaa Xaa Leu Xaa Xaa Leu Xaa Pro Cys Leu Pro Xaa Xaa Thr Ala  
                   80    85                  90  
  
 10 Xaa Pro Xaa Arg Xaa Pro Ile Xaa Xaa Xaa Xaa Gly Asp Trp Xaa  
                   95    100                  105  
  
 Glu Phe Xaa Xaa Lys Leu Xaa Phe Tyr Leu Xaa Xaa Leu Glu Xaa  
                   110  115                  120  
 15  
 Xaa Xaa Xaa Gln Gln Thr Thr Leu Ser Leu Ala Ile Phe [SEQ ID NO:18]  
                   125  130  
  
 wherein  
 Xaa at position 17 is Ser, Gly, Asp, or Gln;  
 20 Xaa at position 18 is Asn, His, or Ile;  
 Xaa at position 23 is Ile, Ala, Leu, or Gly;  
 Xaa at position 25 is Thr, His, or Gln;  
 Xaa at position 26 is His or Ala;  
 Xaa at position 29 is Gln or Asn;  
 25 Xaa at position 30 is Pro or Gly;  
 Xaa at position 32 is Leu, Arg, Asn, or Ala;  
 Xaa at position 34 is Leu, Val, Ser, Ala, Arg, Gln, Glu, Ile,  
                   Phe, Thr, or Met;  
 Xaa at position 35 is Leu, Ala, Asn, or Pro;  
 30 Xaa at position 38 is Asn or Ala;  
 Xaa at position 42 is Gly, Asp, Ser, Ala, Asn, Ile, Leu, Met,  
                   Tyr or Arg;  
 Xaa at position 45 is Gln, Val, Met, Leu, Ala, Asn, Glu, or Lys;  
 Xaa at position 46 is Asp, Phe, Ser, Gln, Glu, His, Val  
 35                  or Thr;  
 Xaa at position 50 is Glu Asn, Ser or Asp;  
 Xaa at position 51 is Asn, Arg, Pro, Thr, or His;

- Xaa at position 55 is Arg, Leu, or Gly;  
 Xaa at position 56 is Pro, Gly, Ser, Ala, Asn, Val, Leu or Gln;  
 Xaa at position 62 is Asn, Pro, or Thr;  
 Xaa at position 64 is Ala or Asn;  
 5 Xaa at position 65 is Val or Thr;  
 Xaa at position 67 is Ser or Phe;  
 Xaa at position 68 is Leu or Phe;  
 Xaa at position 69 is Gln, Ala, Glu, or Arg;  
 Xaa at position 76 is Ser, Val, Asn, Pro, or Gly;  
 10 Xaa at position 77 is Ile or Leu;  
 Xaa at position 79 is Lys, Gly, Asn, Met, Arg, Ile, or Gly;  
 Xaa at position 80 is Asn, Gly, Glu, or Arg;  
 Xaa at position 82 is Leu, Gln, Trp, Arg, Asp, Asn, Glu, His, Met,  
     Phe, Ser, Thr, Tyr or Val;  
 15 Xaa at position 87 is Leu or Ser;  
 Xaa at position 88 is Ala or Trp;  
 Xaa at position 91 is Ala or Pro;  
 Xaa at position 93 is Thr, Asp, or Ala;  
 Xaa at position 95 is His, Pro, Arg, Val, Gly, Asn, Ser or Thr;  
 20 Xaa at position 98 is His, Ile, Asn, Ala, Thr, Gln, Glu,  
     Lys, Met, Ser, Tyr, Val or Leu;  
 Xaa at position 99 is Ile or Leu;  
 Xaa at position 100 is Lys or Arg;  
 Xaa at position 101 is Asp, Pro, Met, Lys, Thr, His, Pro, Asn, Ile,  
 25 Leu or Tyr;  
 Xaa at position 105 is Asn, Pro, Ser, Ile or Asp;  
 Xaa at position 108 is Arg, Ala, or Ser;  
 Xaa at position 109 is Arg, Thr, Glu, Leu, or Ser;  
 Xaa at position 112 is Thr or Gln;  
 30 Xaa at position 116 is Lys, Val, Trp, Ala, His, Phe, Tyr or Ile;  
 Xaa at position 117 is Thr or Ser;  
 Xaa at position 120 is Asn, Pro, Leu, His, Val, or Gln;  
 Xaa at position 121 is Ala, Ser, Ile, Pro, or Asp;  
 Xaa at position 122 is Gln, Met, Trp, Phe, Pro, His, Ile, or Tyr;  
 35 Xaa at position 123 is Ala, Met, Glu, Ser, or Leu;

and which can additionally have Met- preceding the amino acid in

position 1; and wherein from 1 to 14 amino acids can be deleted from the N-terminus and/or from 1 to 15 amino acids can be deleted from the C-terminus; and wherein from 4 to 44 of the amino acids designated by Xaa are different from the corresponding amino acids of native (1-133)human interleukin-3.

5. The human interleukin-3 mutant polypeptide of claim 1 wherein 1-15 amino acids are deleted from the C-terminus and/or 1-14 amino acids are deleted from the N-terminus.

6. The human interleukin-3 mutant polypeptide of claim 1 wherein;

Xaa at position 42 is Gly, Asp, Ser, Ile, Leu, Met, Tyr, or Ala;  
 Xaa at position 45 is Gln, Val, Met or Asn;  
 Xaa at position 46 is Asp, Ser, Gln, His or Val;  
 Xaa at position 50 is Glu or Asp;  
 Xaa at position 51 is Asn, Pro or Thr;  
 Xaa at position 62 is Asn or Pro;  
 Xaa at position 76 is Ser, or Pro;  
 Xaa at position 82 is Leu, Trp, Asp, Asn Glu, His, Phe, Ser or Tyr;  
 Xaa at position 95 is His, Arg, Thr, Asn or Ser;  
 Xaa at position 98 is His, Ile, Leu, Ala, Gln, Lys, Met, Ser, Tyr or Val;  
 Xaa at position 100 is Lys or Arg;  
 Xaa at position 101 is Asp, Pro, His, Asn, Ile or Leu;  
 Xaa at position 105 is Asn, or Pro;  
 Xaa at position 108 is Arg, Ala, or Ser;  
 Xaa at position 116 is Lys, Val, Trp, Ala, His, Phe, or Tyr;  
 Xaa at position 121 is Ala, or Ile;  
 Xaa at position 122 is Gln, or Ile; and  
 Xaa at position 123 is Ala, Met or Glu.

7. A (15-125)human interleukin-3 mutant polypeptide of the Formula V:

Asn Cys Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa



|   |   |     |     |
|---|---|-----|-----|
| 1   | 5   | 10  | 15  |
| Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Asn Xaa Xaa Xaa Xaa Xaa |   |     |     |
|   | 20  | 25  | 30  |
| 5   | Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa           |     |     |
|   | 35  | 40  | 45  |
| Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa     |   |     |     |
| 10  | 50  | 55  | 60  |
| Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa     |   |     |     |
|   | 65  | 70  | 75  |
| Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa     |   |     |     |
| 15  | 80  | 85  | 90  |
| Xaa Xaa Phe Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa     |   |     |     |
|   | 95  | 100 | 105 |
| 20  | Xaa Xaa Xaa Xaa Gln Gln [SEQ ID NO:19]                            |     |     |
|   | 110   |     |     |
| wherein   |   |     |     |
| 25  | Xaa at position 3 is Ser, Lys, Gly, Asp, Met, Gln, or Arg;        |     |     |
|   | Xaa at position 4 is Asn, His, Leu, Ile, Phe, Arg, or Gln;        |     |     |
|   | Xaa at position 5 is Met, Phe, Ile, Arg, Gly, Ala, or Cys;        |     |     |
|   | Xaa at position 6 is Ile, Cys, Gln, Glu, Arg, Pro, or Ala;        |     |     |
|   | Xaa at position 7 is Asp, Phe, Lys, Arg, Ala, Gly, Glu, Gln, Asn, |     |     |
| 30  | Thr, Ser or Val;  |     |     |
|   | Xaa at position 8 is Glu, Trp, Pro, Ser, Ala, His, Asp, Asn, Gln, |     |     |
|   | Leu, Val, or Gly;   |     |     |
|   | Xaa at position 9 is Ile, Val, Ala, Leu, Gly, Trp, Lys, Phe,      |     |     |
|   | Leu, Ser, or Arg;   |     |     |
| 35  | Xaa at position 10 is Ile, Gly, Val, Arg, Ser, Phe, or Leu;       |     |     |
|   | Xaa at position 11 is Thr, His, Gly, Gln, Arg, Pro, or Ala;       |     |     |
|   | Xaa at position 12 is His, Thr, Phe, Gly, Arg, Ala, or Trp;       |     |     |

- Xaa at position 13 is Leu, Gly, Arg, Thr, Ser, or Ala;  
 Xaa at position 14 is Lys, Arg, Leu, Gln, Gly, Pro, Val or Trp;  
 Xaa at position 15 is Gln, Asn, Leu, Pro, Arg, or Val;  
 Xaa at position 16 is Pro, His, Thr, Gly, Asp, Gln, Ser, Leu, or  
 5 Lys;  
 Xaa at position 17 is Pro, Asp, Gly, Ala, Arg, Leu, or Gln;  
 Xaa at position 18 is Leu, Val, Arg, Gln, Asn, Gly, Ala, or Glu;  
 Xaa at position 19 is Pro, Leu, Gln, Ala, Thr, or Glu;  
 Xaa at position 20 is Leu, Val, Gly, Ser, Lys, Glu, Gln, Thr,  
 10 Arg, Ala, Phe, Ile or Met;  
 Xaa at position 21 is Leu, Ala, Gly, Asn, Pro, Gln, or Val;  
 Xaa at position 22 is Asp, Leu, or Val;  
 Xaa at position 23 is Phe, Ser, Pro, Trp, or Ile;  
 Xaa at position 24 is Asn, or Ala;  
 15 Xaa at position 26 is Leu, Trp, or Arg;  
 Xaa at position 27 is Asn, Cys, Arg, Leu, His, Met, Pro;  
 Xaa at position 28 is Gly, Asp, Ser, Cys, Ala, Lys, Asn, Thr, Leu,  
 Val, Glu, Phe, Tyr, Ile or Met;  
 Xaa at position 29 is Glu, Asn, Tyr, Leu, Phe, Asp, Ala, Cys, Gln,  
 20 Arg, Thr, Gly or Ser;  
 Xaa at position 30 is Asp, Ser, Leu, Arg, Lys, Thr, Met, Trp, Glu,  
 Asn, Gln, Ala or Pro;  
 Xaa at position 31 is Gln, Pro, Phe, Val, Met, Leu, Thr, Lys, Asp,  
 Asn, Arg, Ser, Ala, Ile, Glu, His or Trp;  
 25 Xaa at position 32 is Asp, Phe, Ser, Thr, Cys, Glu, Asn, Gln,  
 Lys, His, Ala, Tyr, Ile, Val or Gly;  
 Xaa at position 33 is Ile, Gly, Val, Ser, Arg, Pro, or His;  
 Xaa at position 34 is Leu, Ser, Cys, Arg, Ile, His, Phe, Glu,  
 Lys, Thr, Ala, Met, Val or Asn;  
 30 Xaa at position 35 is Met, Arg, Ala, Gly, Pro, Asn, His, or Asp;  
 Xaa at position 36 is Glu, Leu, Thr, Asp, Tyr, Lys, Asn, Ser, Ala,  
 Ile, Val, His, Phe, Met or Gln;  
 Xaa at position 37 is Asn, Arg, Met, Pro, Ser, Thr, or His;  
 Xaa at position 38 is Asn, His, Arg, Leu, Gly, Ser, or Thr;  
 35 Xaa at position 39 is Leu, Thr, Ala, Gly, Glu, Pro, Lys, Ser,  
 Met, or;  
 Xaa at position 40 is Arg, Asp, Ile, Ser, Val, Thr, Gln, Asn,

Lys, His, Ala or Leu;

Xaa at position 41 is Arg, Thr, Val, Ser, Leu, or Gly;

Xaa at position 42 is Pro, Gly, Cys, Ser, Gln, Glu, Arg, His,  
Thr, Ala, Tyr, Phe, Leu, Val or Lys;

5 Xaa at position 43 is Asn or Gly;

Xaa at position 44 is Leu, Ser, Asp, Arg, Gln, Val, or Cys;

Xaa at position 45 is Glu Tyr, His, Leu, Pro, or Arg;

Xaa at position 46 is Ala, Ser, Pro, Tyr, Asn, or Thr;

Xaa at position 47 is Phe, Asn, Glu, Pro, Lys, Arg, or Ser;

10 Xaa at position 48 is Asn, His, Val, Arg, Pro, Thr, Asp, or Ile;

Xaa at position 49 is Arg, Tyr, Trp, Lys, Ser, His, Pro, or Val;

Xaa at position 50 is Ala, Asn, Pro, Ser, or Lys;

Xaa at position 51 is Val, Thr, Pro, His, Leu, Phe, or Ser;

Xaa at position 52 is Lys, Ile, Arg, Val, Asn, Glu, or Ser;

15 Xaa at position 53 is Ser, Ala, Phe, Val, Gly, Asn, Ile, Pro, or  
His;

Xaa at position 54 is Leu, Val, Trp, Ser, Ile, Phe, Thr, or His;

Xaa at position 55 is Gln, Ala, Pro, Thr, Glu, Arg, Trp, Gly, or  
Leu;

20 Xaa at position 56 is Asn, Leu, Val, Trp, Pro, or Ala;

Xaa at position 57 is Ala, Met, Leu, Pro, Arg, Glu, Thr, Gln,  
Trp, or Asn;

Xaa at position 58 is Ser, Glu, Met, Ala, His, Asn, Arg, or Asp;

Xaa at position 59 is Ala, Glu, Asp, Leu, Ser, Gly, Thr, or Arg;

25 Xaa at position 60 is Ile, Met, Thr, Pro, Arg, Gly, Ala;

Xaa at position 61 is Glu, Lys, Gly, Asp, Pro, Trp, Arg, Ser,  
Gln, or Leu;

Xaa at position 62 is Ser, Val, Ala, Asn, Trp, Glu, Pro, Gly, or  
Asp;

30 Xaa at position 63 is Ile, Ser, Arg, Thr, or Leu;

Xaa at position 64 is Leu, Ala, Ser, Glu, Phe, Gly, or Arg;

Xaa at position 65 is Lys, Thr, Gly, Asn, Met, Arg, Ile, or  
Asp;

Xaa at position 66 is Asn, Trp, Val, Gly, Thr, Leu, Glu, or Arg;

35 Xaa at position 67 is Leu, Gln, Gly, Ala, Trp, Arg, Val, or Lys;

Xaa at position 68 is Leu, Gln, Lys, Trp, Arg, Asp, Glu, Asn,  
His, Thr, Ser, Ala, Tyr, Phe, Ile, Met or Val;

- Xaa at position 69 is Pro, Ala, Thr, Trp, Arg, or Met;  
 Xaa at position 70 is Cys, Glu, Gly, Arg, Met, or Val;  
 Xaa at position 71 is Leu, Asn, Val, or Gln;  
 Xaa at position 72 is Pro, Cys, Arg, Ala, or Lys;  
 5 Xaa at position 73 is Leu, Ser, Trp, or Gly;  
 Xaa at position 74 is Ala, Lys, Arg, Val, or Trp;  
 Xaa at position 75 is Thr, Asp, Cys, Leu, Val, Glu, His, Asn, or  
 Ser;  
 Xaa at position 76 is Ala, Pro, Ser, Thr, Gly, Asp, Ile, or Met;  
 10 Xaa at position 77 is Ala, Pro, Ser, Thr, Phe, Leu, Asp, or His;  
 Xaa at position 78 is Pro, Phe, Arg, Ser, Lys, His, Ala, Gly, Ile  
 or Leu;  
 Xaa at position 79 is Thr, Asp, Ser, Asn, Pro, Ala, Leu, or Arg;  
 Xaa at position 80 is Arg, Ile, Ser, Glu, Leu, Val, Gln, Lys, His,  
 15 Ala or Pro;  
 Xaa at position 81 is His, Gln, Pro, Arg, Val, Leu, Gly, Thr, Asn,  
 Lys, Ser, Ala, Trp, Phe, Ile or Tyr;  
 Xaa at position 82 is Pro, Lys, Tyr, Gly, Ile, or Thr;  
 Xaa at position 83 is Ile, Val, Lys, Ala, or Asn;  
 20 Xaa at position 84 is His, Ile, Asn, Leu, Asp, Ala, Thr, Glu,  
 Gln, Ser, Phe, Met, Val, Lys, Arg, Tyr or Pro;  
 Xaa at position 85 is Ile, Leu, Arg, Asp, Val, Pro, Gln,  
 Gly, Ser, Phe, or His;  
 Xaa at position 86 is Lys, Tyr, Leu, His, Arg, Ile, Ser, Gln,  
 25 Pro;  
 Xaa at position 87 is Asp, Pro, Met, Lys, His, Thr, Val,  
 Tyr, Glu, Asn, Ser, Ala, Gly, Ile, Leu or Gln;  
 Xaa at position 88 is Gly, Leu, Glu, Lys, Ser, Tyr, or Pro;  
 Xaa at position 89 is Asp, or Ser;  
 30 Xaa at position 90 is Trp, Val, Cys, Tyr, Thr, Met, Pro, Leu,  
 Gln, Lys, Ala, Phe, or Gly;  
 Xaa at position 91 is Asn, Pro, Ala, Phe, Ser, Trp, Gln, Tyr,  
 Leu, Lys, Ile, Asp, or His;  
 Xaa at position 92 is Glu, Ser, Ala, Lys, Thr, Ile, Gly, or Pro;  
 35 Xaa at position 94 is Arg, Lys, Asp, Leu, Thr, Ile, Gln,  
 His, Ser, Ala, or Pro;  
 Xaa at position 95 is Arg, Thr, Pro, Glu, Tyr, Leu, Ser, or Gly;



Xaa Xaa Xaa Leu Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Asn Leu Xaa  
 35 40 45

5 Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa  
 50 55 60

Xaa Xaa Xaa Leu Xaa Xaa Xaa Xaa Xaa Cys Xaa Pro Xaa Xaa Xaa  
 65 70 75

10 Xaa Xaa Xaa Xaa Arg Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Asp Xaa  
 80 85 90

Xaa Xaa Phe Xaa Xaa Lys Leu Xaa Phe Xaa Xaa Xaa Xaa Leu Xaa  
 15 95 100 105

Xaa Xaa Xaa Xaa Gln Gln [SEQ ID NO:20]  
 110

20 wherein  
 Xaa at position 3 is Ser, Gly, Asp, Met, or Gln;  
 Xaa at position 4 is Asn, His, Leu, Ile, Phe, Arg, or Gln;  
 Xaa at position 5 is Met, Phe, Ile, Arg, or Ala;  
 Xaa at position 6 is Ile or Pro;

25 Xaa at position 7 is Asp, or Glu;  
 Xaa at position 9 is Ile, Val, Ala, Leu, or Gly;  
 Xaa at position 10 is Ile, Val, Phe, or Leu;  
 Xaa at position 11 is Thr, His, Gly, Gln, Arg, Pro, or Ala;  
 Xaa at position 12 is His, Phe, Gly, Arg, or Ala;

30 Xaa at position 14 is Lys, Leu, Gln, Gly, Pro, or Val;  
 Xaa at position 15 is Gln, Asn, Leu, Arg, or Val;  
 Xaa at position 16 is Pro, His, Thr, Gly, or Gln;  
 Xaa at position 17 is Pro, Asp, Gly, Ala, Arg, Leu, or Gln;  
 Xaa at position 18 is Leu, Arg, Gln, Asn, Gly, Ala, or Glu;

35 Xaa at position 19 is Pro, Leu, Gln, Ala, or Glu;  
 Xaa at position 20 is Leu, Val, Gly, Ser, Lys, Ala, Arg, Gln,  
 Glu, Ile, Phe, Thr or Met;

- Xaa at position 21 is Leu, Ala, Asn, Pro, Gln, or Val;  
 Xaa at position 22 is Asp or Leu;  
 Xaa at position 23 is Phe, Ser, Pro, Trp, or Ile;  
 Xaa at position 24 is Asn or Ala;
- 5 Xaa at position 27 is Asn, Cys, Arg, His, Met, or Pro;  
 Xaa at position 28 is Gly, Asp, Ser, Cys, Ala, Asn, Ile, Leu,  
 Met, Tyr, or Arg;  
 Xaa at position 30 is Asp, or Glu;  
 Xaa at position 31 is Gln, Val, Met, Leu, Thr, Lys, Ala, Asn Glu,
- 10 Ser or Trp;  
 Xaa at position 32 is Asp, Phe, Ser, Thr, Cys, Ala, Asn, Gln,  
 Glu, His, Ile, Lys, Tyr, Val or Gly;  
 Xaa at position 33 is Ile, Val, or His;  
 Xaa at position 35 is Met, Asn, or Asp;
- 15 Xaa at position 36 is Glu, Thr, Ala, Asn, Ser or Asp;  
 Xaa at position 37 is Asn, Arg, Met, Pro, Ser, Thr, or His;  
 Xaa at position 38 is Asn or Gly;  
 Xaa at position 39 is Leu, Met, or Phe;  
 Xaa at position 40 is Arg, Ala or Ser;
- 20 Xaa at position 41 is Arg, Thr, Val, Leu, or Gly;  
 Xaa at position 42 is Pro, Gly, Cys, Ser, Gln, Ala, Arg, Asn,  
 Glu, His, Leu, Thr, Val or Lys;  
 Xaa at position 45 is Glu, Tyr, His, Leu, or Arg;  
 Xaa at position 46 is Ala, Ser, Asn, or Thr;
- 25 Xaa at position 47 is Phe or Ser;  
 Xaa at position 48 is Asn, Val, Pro, Thr, or Ile;  
 Xaa at position 49 is Arg, Tyr, Lys, Ser, His, or Val;  
 Xaa at position 50 is Ala or Asn;  
 Xaa at position 51 is Val, Thr, Leu, or Ser;
- 30 Xaa at position 52 is Lys, Ile, Arg, Val, Asn, Glu, or Ser;  
 Xaa at position 53 is Ser, Phe, Val, Gly, Asn, Ile, or His;  
 Xaa at position 54 is Leu, Val, Ile, Phe, or His;  
 Xaa at position 55 is Gln, Ala, Pro, Thr, Glu, Arg, or Gly;  
 Xaa at position 56 is Asn or Pro;
- 35 Xaa at position 57 is Ala, Met, Pro, Arg, Glu, Thr, or Gln;  
 Xaa at position 58 is Ser, Glu, Met, Ala, His, Asn, Arg, or Asp;  
 Xaa at position 59 is Ala, Glu, Asp, Leu, Ser, Gly, Thr, Arg, or

Pro;

Xaa at position 60 is Ile or Met;

Xaa at position 61 is Glu, Gly, Asp, Ser, or Gln;

Xaa at position 62 is Ser, Val, Ala, Asn, Glu, Pro, Gly, or

5 Asp;

Xaa at position 63 is Ile, Ser, or Leu;

Xaa at position 65 is Lys, Thr, Gly, Asn, Met, Arg, Ile, or

Asp;

Xaa at position 66 is Asn, Val, Gly, Thr, Leu, Glu, or Arg;

10 Xaa at position 67 is Leu, or Val;

Xaa at position 68 is Leu, Gln, Trp, Arg, Asp, Ala, Asn, Glu,

His, Met, Phe, Ser, Thr, Tyr or Val;

Xaa at position 69 is Pro, Ala, Thr, Trp, or Met;

Xaa at position 71 is Leu or Val;

15 Xaa at position 73 is Leu or Ser;

Xaa at position 74 is Ala, Arg, or Trp;

Xaa at position 75 is Thr, Asp, Glu, His, Asn, or Ser;

Xaa at position 76 is Ala, Asp, or Met;

Xaa at position 77 is Ala, Pro, Ser, Thr, Phe, Leu, or Asp;

20 Xaa at position 78 is Pro or Ser;

Xaa at position 79 is Thr, Asp, Ser, Pro, Ala, Leu, or Arg;

Xaa at position 81 is His, Pro, Arg, Val, Leu, Gly, Asn, Ile, Phe,

Ser or Thr;

Xaa at position 82 is Pro or Tyr;

25 Xaa at position 83 is Ile, Val, or Ala;

Xaa at position 84 is His, Ile, Asn, Leu, Asp, Ala, Thr,

Arg, Gln, Glu, Lys, Met, Ser, Tyr, Val or Pro;

Xaa at position 85 is Ile, Leu, Val, or Phe;

Xaa at position 86 is Lys, Leu, His, Arg, Ile, Gln, Pro or

30 Ser;

Xaa at position 87 is Asp, Pro, Met, Lys, His, Thr, Val,

Asn, Ile, Leu or Tyr;

Xaa at position 88 is Gly, Glu, Lys, or Ser;

Xaa at position 90 is Trp, Val, Tyr, Met, or Leu;

35 Xaa at position 91 is Asn, Pro, Ala, Phe, Ser, Trp, Gln, Tyr,

Leu, Lys, Ile, Asp, or His;

Xaa at position 92 is Glu, Ser, Ala, or Gly;



- Xaa at position 94 is Arg, Ala, Gln, Ser or Lys;  
 Xaa at position 95 is Arg, Thr, Glu, Leu, Ser, or Gly;  
 Xaa at position 98 is Thr, Val, Gln, Glu, His, or Ser;  
 Xaa at position 100 is Tyr or Trp;  
 5 Xaa at position 101 is Leu or Ala;  
 Xaa at position 102 is Lys, Thr, Met, Val, Trp, Ser, Leu,  
     Ala, Asn, Gln, His, Met, Phe, Tyr or Ile;  
 Xaa at position 103 is Thr, Ser, or Asn;  
 Xaa at position 105 is Glu, Ser, Pro, Leu, Thr, or Tyr;  
 10 Xaa at position 106 is Asn, Pro, Leu, His, Val, or Gln;  
 Xaa at position 107 is Ala, Ser, Ile, Asn, Pro, Lys, Asp, or  
     Gly;  
 Xaa at position 108 is Gln, Ser, Met, Trp, Arg, Phe, Pro, His,  
     Ile, Tyr, or Cys;  
 15 Xaa at position 109 is Ala, Met, Glu, His, Ser, Pro, Tyr, or Leu;
- and which can additionally have Met- or Met-Ala- preceding the  
 amino acid in position 1; and wherein from 4 to 44 of the amino  
 acids designated by Xaa are different from the corresponding amino  
 20 acids of native (1-133) human interleukin-3; or a polypeptide  
 having substantially the same structure and substantially the same  
 biological activity.

9. A (15-125)human interleukin-3 mutant polypeptide  
 25 according to Claim 7 of the Formula VII:

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Asn | Cys | Xaa | Xaa | Xaa | Ile | Xaa | Glu | Xaa | Xaa | Xaa | Xaa | Leu | Lys | Xaa |
| 1   |     |     | 5   | 10  |     |     |     |     |     |     |     | 15  |     |     |
| Xaa | Xaa | Xaa | Xaa | Xaa | Xaa | Asp | Xaa | Xaa | Asn | Leu | Asn | Xaa | Glu | Xaa |
| 30  |     |     | 20  | 25  |     |     |     |     |     |     |     | 30  |     |     |
| Xaa | Xaa | Ile | Leu | Met | Xaa | Xaa | Asn | Leu | Xaa | Xaa | Xaa | Asn | Leu | Glu |
|     |     |     | 35  | 40  |     |     |     |     |     |     |     | 45  |     |     |
| Xaa | Phe | Xaa | Xaa | Xaa | Xaa | Xaa | Xaa | Xaa | Xaa | Asn | Xaa | Xaa | Xaa | Ile |
| 35  |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|     |     |     | 50  | 55  |     |     |     |     |     |     |     | 60  |     |     |

Glu Xaa Xaa Leu Xaa Xaa Leu Xaa Xaa Cys Xaa Pro Xaa Xaa Thr  
 65 70 75

5 Ala Xaa Pro Xaa Arg Xaa Xaa Xaa Xaa Xaa Xaa Gly Asp Xaa  
 80 85 90

Xaa Xaa Phe Xaa Xaa Lys Leu Xaa Phe Xaa Xaa Xaa Xaa Leu Glu  
 10 95 100 105

Xaa Xaa Xaa Xaa Gln Gln [SEQ ID NO:21]  
 110

15 wherein  
 Xaa at position 3 is Ser, Gly, Asp, Met, or Gln;  
 Xaa at position 4 is Asn, His, or Ile;  
 Xaa at position 5 is Met or Ile;  
 Xaa at position 7 is Asp or Glu;

20 Xaa at position 9 is Ile, Ala, Leu, or Gly;  
 Xaa at position 10 is Ile, Val, or Leu;  
 Xaa at position 11 is Thr, His, Gln, or Ala;  
 Xaa at position 12 is His or Ala;  
 Xaa at position 15 is Gln, Asn, or Val;

25 Xaa at position 16 is Pro, Gly, or Gln;  
 Xaa at position 17 is Pro, Asp, Gly, or Gln;  
 Xaa at position 18 is Leu, Arg, Gln, Asn, Gly, Ala, or Glu;  
 Xaa at position 19 is Pro or Glu;  
 Xaa at position 20 is Leu, Val, Gly, Ser, Lys, Ala, Arg,

30 Gln, Glu, Ile, Phe, Thr or Met;  
 Xaa at position 21 is Leu, Ala, Asn, Pro, Gln, or Val;  
 Xaa at position 23 is Phe, Ser, Pro, or Trp;  
 Xaa at position 24 is Asn or Ala;  
 Xaa at position 28 is Gly, Asp, Ser, Cys, Ala, Asn, Ile,

35 Leu, Met Tyr or Arg;  
 Xaa at position 30 is Asp or Glu;  
 Xaa at position 31 is Gln, Val, Met, Leu, Thr, Ala, Asn,

Glu, Ser or Lys;

Xaa at position 32 is Asp, Phe, Ser, Thr, Ala, Asn, Gln, Glu,  
His, Ile, Lys, Tyr, Val or Cys;

Xaa at position 36 is Glu, Ala, Asn, Ser or Asp;

5 Xaa at position 37 is Asn, Arg, Met, Pro, Ser, Thr, or His;

Xaa at position 40 is Arg or Ala;

Xaa at position 41 is Arg, Thr, Val, Leu, or Gly;

Xaa at position 42 is Pro, Gly, Ser, Gln, Ala, Arg, Asn, Glu, Leu,  
Thr, Val or Lys;

10 Xaa at position 46 is Ala or Ser;

Xaa at position 48 is Asn, Pro, Thr, or Ile;

Xaa at position 49 is Arg or Lys;

Xaa at position 50 is Ala or Asn;

Xaa at position 51 is Val or Thr;

15 Xaa at position 52 is Lys or Arg;

Xaa at position 53 is Ser, Phe, or His;

Xaa at position 54 is Leu, Ile, Phe, or His;

Xaa at position 55 is Gln, Ala, Pro, Thr, Glu, Arg, or Gly;

Xaa at position 57 is Ala, Pro, or Arg;

20 Xaa at position 58 is Ser, Glu, Arg, or Asp;

Xaa at position 59 is Ala or Leu;

Xaa at position 62 is Ser, Val, Ala, Asn, Glu, Pro, or Gly;

Xaa at position 63 is Ile or Leu;

Xaa at position 65 is Lys, Thr, Gly, Asn, Met, Arg, Ile, Gly, or

25 Asp;

Xaa at position 66 is Asn, Gly, Glu, or Arg;

Xaa at position 68 is Leu, Gln, Trp, Arg, Asp, Ala, Asn, Glu,  
His, Ile, Met, Phe, Ser, Thr, Tyr or Val;

Xaa at position 69 is Pro or Thr;

30 Xaa at position 71 is Leu or Val;

Xaa at position 73 is Leu or Ser;

Xaa at position 74 is Ala or Trp;

Xaa at position 77 is Ala or Pro;

Xaa at position 79 is Thr, Asp, Ser, Pro, Ala, Leu, or Arg;

35 Xaa at position 81 is His, Pro, Arg, Val, Leu, Gly, Asn, Phe,  
Ser or Thr;

Xaa at position 82 is Pro or Tyr;

- Xaa at position 83 is Ile or Val;  
 Xaa at position 84 is His, Ile, Asn, Leu, Ala, Thr, Leu, Arg,  
     Gln, Leu, Lys, Met, Ser, Tyr, Val or Pro;  
 Xaa at position 85 is Ile, Leu, or Val;  
 5 Xaa at position 86 is Lys, Arg, Ile, Gln, Pro, or Ser;  
 Xaa at position 87 is Asp, Pro, Met, Lys, His, Thr, Asn, Ile,  
     Leu or Tyr;  
 Xaa at position 90 is Trp or Leu;  
 Xaa at position 91 is Asn, Pro, Ala, Ser, Trp, Gln, Tyr, Leu,  
 10 Lys, Ile, Asp, or His;  
 Xaa at position 92 is Glu, or Gly;  
 Xaa at position 94 is Arg, Ala, or Ser;  
 Xaa at position 95 is Arg, Thr, Glu, Leu, or Ser;  
 Xaa at position 98 is Thr, Val, or Gln;  
 15 Xaa at position 100 is Tyr or Trp;  
 Xaa at position 101 is Leu or Ala;  
 Xaa at position 102 is Lys, Thr, Val, Trp, Ser, Ala, His,  
     Met, Phe, Tyr or Ile;  
 Xaa at position 103 is Thr or Ser;  
 20 Xaa at position 106 is Asn, Pro, Leu, His, Val, or Gln;  
 Xaa at position 107 is Ala, Ser, Ile, Asn, Pro, Asp, or Gly;  
 Xaa at position 108 is Gln, Ser, Met, Trp, Arg, Phe, Pro, His,  
     Ile, Tyr, or Cys;  
 Xaa at position 109 is Ala, Met, Glu, His, Ser, Pro, Tyr, or Leu;  
 25
- which can additionally have Met- or Met-Ala- preceding the amino  
 acid in position 1; and wherein from 4 to 35 of the amino acids  
 designated by Xaa are different from the corresponding amino acids  
 of native human interleukin-3.

30

10. A (15-125)human interleukin-3 mutant polypeptide  
 according to Claim 7 of the Formula VIII:

Asn Cys Xaa Xaa Met Ile Asp Glu Xaa Ile Xaa Xaa Leu Lys Xaa  
 35     1                 5     10                         15

Xaa Pro Xaa Pro Xaa Xaa Asp Phe Xaa Asn Leu Asn Xaa Glu Asp

20 25

30

Xaa Xaa Ile Leu Met Xaa Xaa Asn Leu Arg Xaa Xaa Asn Leu Glu

35 40

45

5

Ala Phe Xaa Arg Xaa Xaa Lys Xaa Xaa Xaa Asn Ala Ser Ala Ile

50 55

60

Glu Xaa Xaa Leu Xaa Xaa Leu Xaa Pro Cys Leu Pro Xaa Xaa Thr

10

65 70

75

Ala Xaa Pro Xaa Arg Xaa Pro Ile Xaa Xaa Xaa Xaa Gly Asp Trp

80 85

90

15 Xaa Glu Phe Xaa Xaa Lys Leu Xaa Phe Tyr Leu Xaa Xaa Leu Glu

95 100

105

Xaa Xaa Xaa Xaa Gln Gln [SEQ ID NO:22]

110

20 wherein

Xaa at position 3 is Ser, Gly, Asp, or Gln;

Xaa at position 4 is Asn, His, or Ile;

Xaa at position 9 is Ile, Ala, Leu, or Gly;

Xaa at position 11 is Thr, His, or Gln;

25 Xaa at position 12 is His or Ala;

Xaa at position 15 is Gln or Asn;

Xaa at position 16 is Pro or Gly;

Xaa at position 18 is Leu, Arg, Asn, or Ala;

Xaa at position 20 is Leu, Val, Ser, Ala, Arg, Gln, Glu, Ile,

30 Phe, Thr or Met;

Xaa at position 21 is Leu, Ala, Asn, or Pro;

Xaa at position 24 is Asn or Ala;

Xaa at position 28 is Gly, Asp, Ser, Ala, Asn, Ile, Leu, Met,

Tyr or Arg;

35 Xaa at position 31 is Gln, Val, Met, Leu, Ala, Asn, Glu or Lys;

Xaa at position 32 is Asp, Phe, Ser, Ala, Gln, Glu, His, Val

or Thr;

- Xaa at position 36 is Glu, Asn, Ser or Asp;  
 Xaa at position 37 is Asn, Arg, Pro, Thr, or His;  
 Xaa at position 41 is Arg, Leu, or Gly;  
 Xaa at position 42 is Pro, Gly, Ser, Ala, Asn, Val, Leu or Gln;
- 5 Xaa at position 48 is Asn, Pro, or Thr;  
 Xaa at position 50 is Ala or Asn;  
 Xaa at position 51 is Val or Thr;  
 Xaa at position 53 is Ser or Phe;  
 Xaa at position 54 is Leu or Phe;
- 10 Xaa at position 55 is Gln, Ala, Glu, or Arg;  
 Xaa at position 62 is Ser, Val, Asn, Pro, or Gly;  
 Xaa at position 63 is Ile or Leu;  
 Xaa at position 65 is Lys, Asn, Met, Arg, Ile, or Gly;  
 Xaa at position 66 is Asn, Gly, Glu, or Arg;
- 15 Xaa at position 68 is Leu, Gln, Trp, Arg, Asp, Asn, Glu, His,  
 Met, Phe, Ser, Thr, Tyr or Val;  
 Xaa at position 73 is Leu or Ser;  
 Xaa at position 74 is Ala or Trp;  
 Xaa at position 77 is Ala or Pro;
- 20 Xaa at position 79 is Thr, Asp, or Ala;  
 Xaa at position 81 is His, Pro, Arg, Val, Gly, Asn, Ser or Thr;  
 Xaa at position 84 is His, Ile, Asn, Ala, Thr, Arg, Gln, Glu,  
 Lys, Met, Ser, Tyr, Val or Leu;  
 Xaa at position 85 is Ile or Leu;
- 25 Xaa at position 86 is Lys or Arg;  
 Xaa at position 87 is Asp, Pro, Met, Lys, His, Pro, Asn, Ile, Leu  
 or Tyr;  
 Xaa at position 91 is Asn, Pro, Ser, Ile or Asp;  
 Xaa at position 94 is Arg, Ala, or Ser;
- 30 Xaa at position 95 is Arg, Thr, Glu, Leu, or Ser;  
 Xaa at position 98 is Thr or Gln;  
 Xaa at position 102 is Lys, Val, Trp, or Ile;  
 Xaa at position 103 is Thr, Ala, His, Phe, Tyr or Ser;  
 Xaa at position 106 is Asn, Pro, Leu, His, Val, or Gln;
- 35 Xaa at position 107 is Ala, Ser, Ile, Pro, or Asp;  
 Xaa at position 108 is Gln, Met, Trp, Phe, Pro, His, Ile, or Tyr;  
 Xaa at position 109 is Ala, Met, Glu, Ser, or Leu;

and which can additionally have Met- or Met-Ala- preceding the amino acid in position 1; and wherein from 4 to 26 of the amino acids designated by Xaa are different from the corresponding amino acids of native (1-133)human interleukin-3; or a polypeptide having  
 5 substantially the same structure and substantially the same biological activity.

11. A (15-125) human interleukin-3 mutant polypeptide  
 10 of claim 7 wherein:

Xaa at position 17 is Ser, Lys, Asp, Met, Gln, or Arg;  
 Xaa at position 18 is Asn, His, Leu, Ile, Phe, Arg, or Gln;  
 Xaa at position 19 is Met, Arg, Gly, Ala, or Cys;  
 15 Xaa at position 20 is Ile, Cys, Gln, Glu, Arg, Pro, or Ala;  
 Xaa at position 21 is Asp, Phe, Lys, Arg, Ala, Gly, or Val;  
 Xaa at position 22 is Glu, Trp, Pro, Ser, Ala, His, or Gly;  
 Xaa at position 23 is Ile, Ala, Gly, Trp, Lys, Leu, Ser, or Arg;  
 Xaa at position 24 is Ile, Gly, Arg, or Ser;  
 20 Xaa at position 25 is Thr, His, Gly, Gln, Arg, Pro, or Ala;  
 Xaa at position 26 is His, Thr, Phe, Gly, Ala, or Trp;  
 Xaa at position 27 is Leu, Gly, Arg, Thr, Ser, or Ala;  
 Xaa at position 28 is Lys, Leu, Gln, Gly, Pro, Val or Trp;  
 Xaa at position 29 is Gln, Asn, Loh, Pro, Arg, or Val;  
 25 Xaa at position 30 is Pro, His, Thr, Gly, Asp, Gln, Ser, Leu, or Lys;  
 Xaa at position 31 is Pro, Asp, Gly, Arg, Leu, or Gln;  
 Xaa at position 32 is Leu, Arg, Gln, Asn, Gly, Ala, or Glu;  
 Xaa at position 33 is Pro, Leu, Gln, Thr, or Glu;  
 30 Xaa at position 34 is Leu, Gly, Ser, or Lys;  
 Xaa at position 35 is Leu, Ala, Gly, Asn, Pro, or Gln;  
 Xaa at position 36 is Asp, Leu, or Val;  
 Xaa at position 37 is Phe, Ser, or Pro;  
 Xaa at position 38 is Asn, or Ala;  
 35 Xaa at position 40 is Leu, Trp, or Arg;  
 Xaa at position 41 is Asn, Cys, Arg, Leu, His, Met, Pro;  
 Xaa at position 42 is Gly, Asp, Ser, Cys, or Ala;

- Xaa at position 42 is Glu, Asn, Tyr, Leu, Phe, Asp, Ala, Cys, or Ser;
- Xaa at position 44 is Asp, Ser, Leu, Arg, Lys, Thr, Met, Trp, or Pro;
- 5 Xaa at position 45 is Gln, Pro, Phe, Val, Met, Leu, Thr, Lys, or Trp;
- Xaa at position 46 is Asp, Phe, Ser, Thr, Cys, or Gly;
- Xaa at position 47 is Ile, Gly, Ser, Arg, Pro, or His;
- Xaa at position 48 is Leu, Ser, Cys, Arg, His, Phe, or Asn;
- 10 Xaa at position 49 is Met, Arg, Ala, Gly, Pro, Asn, His, or Asp;
- Xaa at position 50 is Glu, Leu, Thr, Asp, or Tyr;
- Xaa at position 51 is Asn, Arg, Met, Pro, Ser, Thr, or His;
- Xaa at position 52 is Asn, His, Arg, Leu, Gly, Ser, or Thr;
- Xaa at position 53 is Leu, Thr, Ala, Gly, Glu, Pro, Lys, Ser, or;
- 15 Xaa at position 54 is Arg, Asp, Ile, Ser, Val, Thr, Gln, or Leu;
- Xaa at position 55 is Arg, Thr, Val, Ser, Leu, or Gly;
- Xaa at position 56 is Pro, Gly, Cys, Ser, Gln, or Lys;
- Xaa at position 57 is Asn or Gly;
- Xaa at position 58 is Leu, Ser, Asp, Arg, Gln, Val, or Cys;
- 20 Xaa at position 59 is Glu Tyr, His, Leu, Pro, or Arg;
- Xaa at position 60 is Ala, Ser, Tyr, Asn, or Thr;
- Xaa at position 61 is Phe, Asn, Glu, Pro, Lys, Arg, or Ser;
- Xaa at position 62 is Asn His, Val, Arg, Pro, Thr, or Ile;
- Xaa at position 63 is Arg, Tyr, Trp, Ser, Pro, or Val;
- 25 Xaa at position 64 is Ala, Asn, Ser, or Lys;
- Xaa at position 65 is Val, Thr, Pro, His, Leu, Phe, or Ser;
- Xaa at position 66 is Lys, Ile, Val, Asn, Glu, or Ser;
- Xaa at position 67 is Ser, Ala, Phe, Val, Gly, Asn, Ile, Pro, or His;
- 30 Xaa at position 68 is Leu, Val, Trp, Ser, Thr, or His;
- Xaa at position 69 is Gln, Ala, Pro, Thr, Arg, Trp, Gly, or Leu;
- Xaa at position 70 is Asn, Leu, Val, Trp, Pro, or Ala;
- Xaa at position 71 is Ala, Met, Leu, Arg, Glu, Thr, Gln, Trp, or Asn;
- 35 Xaa at position 72 is Ser, Glu, Met, Ala, His, Asn, Arg, or Asp;
- Xaa at position 73 is Ala, Glu, Asp, Leu, Ser, Gly, Thr, or Arg;
- Xaa at position 74 is Ile, Thr, Pro, Arg, Gly, Ala;



- Xaa at position 75 is Glu, Lys, Gly, Asp, Pro, Trp, Arg, Ser, or Leu;
- Xaa at position 76 is Ser, Val, Ala, Asn, Trp, Glu, Pro, Gly, or Asp;
- 5 Xaa at position 77 is Ile, Ser, Arg, or Thr;  
 Xaa at position 78 is Leu, Ala, Ser, Glu, Gly, or Arg;  
 Xaa at position 79 is Lys, Thr, Gly, Asn, Met, Ile, or Asp;
- Xaa at position 80 is Asn, Trp, Val, Gly, Thr, Leu, or Arg;
- 10 Xaa at position 81 is Leu, Gln, Gly, Ala, Trp, Arg, or Lys;  
 Xaa at position 82 is Leu, Gln, Lys, Trp, Arg, or Asp;  
 Xaa at position 83 is Pro, Thr, Trp, Arg, or Met;  
 Xaa at position 84 is Cys, Glu, Gly, Arg, Met, or Val;  
 Xaa at position 85 is Leu, Asn, or Gln;
- 15 Xaa at position 86 is Pro, Cys, Arg, Ala, or Lys;  
 Xaa at position 87 is Leu, Ser, Trp, or Gly;  
 Xaa at position 88 is Ala, Lys, Arg, Val, or Trp;  
 Xaa at position 89 is Thr, Asp, Cys, Leu, Val, Glu, His, or Asn;  
 Xaa at position 90 is Ala, Ser, Asp, Ile, or Met;
- 20 Xaa at position 91 is Ala, Ser, Thr, Phe, Leu, Asp, or His;  
 Xaa at position 92 is Pro, Phe, Arg, Ser, Lys, His, or Leu;  
 Xaa at position 93 is Thr, Asp, Ser, Asn, Pro, Ala, Leu, or Arg;  
 Xaa at position 94 is Arg, Ile, Ser, Glu, Leu, Val, or Pro;  
 Xaa at position 95 is His, Gln, Pro, Val, Leu, Thr or Tyr;
- 25 Xaa at position 96 is Pro, Lys, Tyr, Gly, Ile, or Thr;  
 Xaa at position 97 is Ile, Lys, Ala, or Asn;  
 Xaa at position 98 is His, Ile, Asn, Leu, Asp, Ala, Thr, or Pro;  
 Xaa at position 99 is Ile, Arg, Asp, Pro, Gln, Gly, Phe, or His;  
 Xaa at position 100 is Lys, Tyr, Leu, His, Ile, Ser, Gln, or Pro;
- 30 Xaa at position 101 is Asp, Pro, Met, Lys, His, Thr, Val, Tyr, or Gln;  
 Xaa at position 102 is Gly, Leu, Glu, Lys, Ser, Tyr, or Pro;  
 Xaa at position 103 is Asp, or Ser;  
 Xaa at position 104 is Trp, Val, Cys, Tyr, Thr, Met, Pro, Leu,
- 35 Gln, Lys, Ala, Phe, or Gly;  
 Xaa at position 105 is Asn, Pro, Ala, Phe, Ser, Trp, Gln, Tyr, Leu, Lys, Ile, or His;

Xaa at position 106 is Glu, Ser, Ala, Lys, Thr, Ile, Gly, or Pro;  
 Xaa at position 108 is Arg, Asp, Leu, Thr, Ile, or Pro;  
 Xaa at position 109 is Arg, Thr, Pro, Glu, Tyr, Leu, Ser, or Gly.

5                   12. The human interleukin-3 mutant polypeptide of claim  
 7:

wherein;

Xaa at position 28 is Gly, Asp, Ser, Ile, Leu, Met, Tyr, or Ala;  
 10 Xaa at position 31 is Gln, Val, Met or Asn;  
 Xaa at position 32 is Asp, Ser, Ala, Gln, His or Val;  
 Xaa at position 36 is Glu or Asp;  
 Xaa at position 37 is Asn, Pro or Thr;  
 Xaa at position 48 is Asn or Pro;  
 15 Xaa at position 62 is Ser, or Pro;  
 Xaa at position 68 is Leu, Trp, Asp, Asn Glu, His, Phe, Ser or Tyr;  
 Xaa at position 81 is His, Arg, Thr, Asn or Ser;  
 Xaa at position 84 is His, Ile, Leu, Ala, Arg, Gln, Lys, Met, Ser,  
       Tyr or Val;  
 20 Xaa at position 86 is Lys or Arg;  
 Xaa at position 87 is Asp, Pro, His, Asn, Ile or Leu;  
 Xaa at position 91 is Asn, or Pro;  
 Xaa at position 94 is Arg, Ala, or Ser;  
 Xaa at position 102 is Lys, Val, Trp, Ala, His, Phe, or Tyr;  
 25 Xaa at position 107 is Ala, or Ile;  
 Xaa at position 108 is Gln, or Ile; and  
 Xaa at position 109 is Ala, Met or Glu.

30                   13. A polypeptide of the formula

|    |   |   |    |
|----|---|---|----|
|    | 1   | 5                                       | 10 |
|    | (Met) <sub>m</sub> -Ala                             | Pro Met Thr Gln Thr Thr Ser Leu Lys Thr |    |
|    | 15  | 20                                      |    |
|    | Ser Trp Val Asn Cys Ser Xaa Xaa Xaa Asp Glu Ile Ile |   |    |
| 35 | 25  | 30                                      | 35 |
|    | Xaa His Leu Lys Xaa Pro Pro Xaa Pro Xaa Leu Asp Xaa |   |    |
|    | 40  | 45                                      | 50 |

```

Xaa Asn Leu Asn Xaa Glu Asp Xaa Asp Ile Leu Xaa Glu
      55                      60
Xaa Asn Leu Arg Xaa Xaa Asn Leu Xaa Xaa Phe Xaa Xaa
      65                      70                      75
5  Ala Xaa Lys Xaa Leu Xaa Asn Ala Ser Xaa Ile Glu Xaa
      80                      85
Ile Leu Xaa Asn Leu Xaa Pro Cys Xaa Pro Xaa Xaa Thr
90                      95                      100
Ala Xaa Pro Xaa Arg Xaa Pro Ile Xaa Ile Xaa Xaa Gly
10      105                      110                      115
Asp Trp Xaa Glu Phe Arg Xaa Lys Leu Xaa Phe Tyr Leu
      120                      125
Xaa Xaa Leu Glu Xaa Ala Gln Xaa Gln Gln Thr Thr Leu
      130
15 Ser Leu Ala Ile Phe [SEQ ID NO:129]

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wherein m is 0 or 1; Xaa at position 18 is Asn or Ile;  
Xaa at position 19 is Met, Ala or Ile; Xaa at position 20  
is Ile, Pro or Ile; Xaa at position 23 is Ile, Ala or  
20 Leu; Xaa at position 25 is Thr or His; Xaa at position 29  
is Gln, Arg, Val or Ile; Xaa at position 32 is Leu, Ala,  
Asn or Arg; Xaa at position 34 is Leu or Ser; Xaa at  
position 37 is Phe, Pro, or Ser; Xaa at position 38 is  
Asn or Ala; Xaa at position 42 is Gly, Ala, Ser, Asp or  
25 Asn; Xaa at position 45 is Gln, Val, or Met; Xaa at  
position 46 is Asp or Ser; Xaa at position 49 is Met,  
Ile, Leu or Asp; Xaa at position 50 is Glu or Asp; Xaa at  
position 51 is Asn Arg or Ser; Xaa at position 55 is Arg,  
Leu, or Thr; Xaa at position 56 is Pro or Ser; Xaa at  
30 position 59 is Glu or Leu; Xaa at position 60 is Ala or  
Ser; Xaa at position 62 is Asn, Val or Pro; Xaa at  
position 63 is Arg or His; Xaa at position 65 is Val or  
Ser; Xaa at position 67 is Ser, Asn, His or Gln; Xaa at  
position 69 is Gln or Glu; Xaa at position 73 is Ala or  
35 Gly; Xaa at position 76 is Ser, Ala or Pro; Xaa at  
position 79 is Lys, Arg or Ser; Xaa at position 82 is  
Leu, Glu, Val or Trp; Xaa at position 85 is Leu or Val;  
Xaa at position 87 is Leu, Ser, Tyr; Xaa at position 88

is Ala or Trp; Xaa at position 91 is Ala or Pro; Xaa at position 93 is Pro or Ser; Xaa at position 95 is His or Thr; Xaa at position 98 is His, Ile, or Thr; Xaa at position 100 is Lys or Arg; Xaa at position 101 is Asp, Ala or Met; Xaa at position 105 is Asn or Glu; Xaa at position 109 is Arg, Glu or Leu; Xaa at position 112 is Thr or Gln; Xaa at position 116 is Lys, Val, Trp or Ser; Xaa at position 117 is Thr or Ser; Xaa at position 120 is Asn, Gln, or His; Xaa at position 123 is Ala or Glu; with the proviso that from four to forty-four of the amino acids designated by Xaa are different from the corresponding amino acids of native human interleukin-3; or a polypeptide having substantially the same structure and substantially the same biological activity.

15

14. A polypeptide according to Claim 13 wherein Xaa at position 18 is Ile; Xaa at position 19 is Ala, or Ile; Xaa at position 20 is Pro, or Leu; Xaa at position 23 is Ala, or Leu; Xaa at position 25 is His; Xaa at position 29 is Arg, Val, or Ile; Xaa at position 32 is Ala, Asn or Arg; Xaa at position 34 is Ser; Xaa at position 37 is Pro or Ser; Xaa at position 38 is Ala; Xaa at position 42 is Ala, Ser, Asp, or Asn; and Xaa at position 45 is Val or Met; Xaa at position 46 is Ser.

25

15. A polypeptide according to Claim 13 wherein Xaa at position 49 is Ile, or Leu, or Asp; Xaa at position 50 is Asp; Xaa at position 51 is Arg or Ser; Xaa at position 55 is Leu or Thr; Xaa at position 56 is Ser; Xaa at position 59 is Glu or Leu; Xaa at position 60 is Ala or Ser; Xaa at position 62 is Val, or Pro; Xaa at position 63 is His; Xaa at position 65 is Ser; Xaa at position 67 is Asn, or His, or Gln; and Xaa at position 69 is Glu.

35

16. A polypeptide according to Claim 13

wherein Xaa at position 73 is Gly; Xaa at position 76 is Ala, or Pro; Xaa at position 79 is Arg, or Ser; Xaa at position 82 is Gln or Val, or Trp; Xaa at position 85 is Val; Xaa at position 87 is Ser, or Tyr; Xaa at position  
5 88 is Trp; Xaa at position 91 is Pro; Xaa at position 93 is Ser; Xaa at position 95 is Thr; Xaa at position 98 is Ile or Thr; Xaa at position 100 is Arg; Xaa at position 101 is Ala, or Met; and Xaa at position 105 is Glu.

17. A polypeptide according to Claim 13  
wherein Xaa at position 109 is Glu, or Leu; Xaa at  
position 112 is Gln; Xaa at position 116 is Val, or Trp,  
or Ser; Xaa at position 117 is Ser; Xaa at position 120  
5 is Glu or His; and Xaa at position 123 is Glu.

18. A polypeptide according to Claim 13  
wherein Xaa at position 18 is Ile; Xaa at position 19 is  
Ala, or Ile; Xaa at position 20 is Pro, or Leu; Xaa at  
10 position 23 is Ala, or Leu; Xaa at position 25 is His;  
Xaa at position 29 is Arg or Val, or Ile; Xaa at position  
32 is Ala or Asn, or Arg; Xaa at position 34 is Ser; Xaa  
at position 37 is Pro or Ser; Xaa at position 38 is Ala;  
Xaa at position 42 is Ala or Ser, Asp or Asn; Xaa at  
15 position 45 is Val or Met; Xaa at position 46 is Ser; Xaa  
at position 49 is Ile, or Leu, or Asp; Xaa at position 50  
is Asp; Xaa at position 51 is Arg, or Ser; Xaa at  
position 55 is Leu or Thr; Xaa at position 56 is Ser; Xaa  
at position 59 is Glu or Leu; Xaa at position 60 is Ala  
20 or Ser; Xaa at position 62 is Val, or Pro; Xaa at  
position 63 is His; Xaa at position 65 is Ser; Xaa at  
position 67 is Asn, or His, or Gln; and Xaa at position  
69 is Glu.

25 19. A polypeptide according to Claim 13  
wherein Xaa at position 73 is Gly; Xaa at position 76 is  
Ala, or Pro; Xaa at position 79 is Arg, or Ser; Xaa at  
position 82 is Gln or Val, or Trp; Xaa at position 85 is  
Val; Xaa at position 87 is Ser, or Tyr; Xaa at position  
30 88 is Trp; Xaa at position 91 is Pro; Xaa at position 93  
is Ser; Xaa at position 95 is Thr; Xaa at position 98 is  
Ile or Thr; Xaa at position 100 is Arg; Xaa at position  
101 is Ala, or Met; Xaa at position 105 is Glu; Xaa at  
position 109 is Glu, or Leu; Xaa at position 112 is Gln;  
35 Xaa at position 116 is Val, or Trp, or Ser; Xaa at  
position 117 is Ser; Xaa at position 120 is Glu or His;  
and Xaa at position 123 is Glu.

## 20. A polypeptide of the formula

|    |  |     |     |
|----|--|-----|-----|
|    | 1  | 5   | 10  |
|    | (Met <sub>m</sub> -Alan) <sub>p</sub> -Asn Cys Ser Xaa Xaa Xaa Asp Glu Xaa Ile |     |     |
| 5  | 15   | 20  |     |
|    | Xaa His Leu Lys Xaa Pro Pro Xaa Pro Xaa Leu Asp Xaa                            |     |     |
|    | 25   | 30  | 35  |
|    | Xaa Asn Leu Asn Xaa Glu Asp Xaa Xaa Ile Leu Xaa Glu                            |     |     |
| 10 | 40   | 45  |     |
|    | Xaa Asn Leu Arg Xaa Xaa Asn Leu Xaa Xaa Phe Xaa Xaa                            |     |     |
|    | 50   | 55  | 60  |
|    | Ala Xaa Lys Xaa Leu Xaa Asn Ala Ser Xaa Ile Glu Xaa                            |     |     |
|    | 65   | 70  | 75  |
| 15 | Ile Leu Xaa Asn Xaa Xaa Pro Cys Xaa Pro Xaa Ala Thr                            |     |     |
|    | 80   | 85  |     |
|    | Ala Xaa Pro Xaa Arg Xaa Pro Ile Xaa Ile Xaa Xaa Gly                            |     |     |
|    | 90   | 95  | 100 |
|    | Asp Trp Xaa Glu Phe Arg Xaa Lys Leu Xaa Phe Tyr Leu                            |     |     |
| 20 | 105  | 110 |     |
|    | Xaa Xaa Leu Glu Xaa Ala Gln Xaa Gln Gln [SEQ ID NO:130]                        |     |     |

wherein m is 0 or 1; n is 0 or 1; p is 0 or 1; Xaa at position 4 is Asn or Ile; Xaa at position 5 is Met, Ala or Ile; Xaa at position 6 is Ile, Pro or Leu; Xaa at position 9 is Ile, Ala or Leu; Xaa at position 11 is Thr or His; Xaa at position 15 is Gln, Arg, Val or Ile; Xaa at position 18 is Leu, Ala, Asn or Arg; Xaa at position 20 is Leu or Ser; Xaa at position 23 is Phe, Pro, or Ser; Xaa at position 24 is Asn or Ala; Xaa at position 28 is Gly, Ala, Ser, Asp or Asn; Xaa at position 31 is Gln, Val, or Met; Xaa at position 32 is Asp or Ser; Xaa at position 35 is Met, Ile or Asp; Xaa at position 36 is Glu or Asp; Xaa at position 37 is Asn, Arg or Ser; Xaa at position 41 is Arg, Leu, or Thr; Xaa at position 42 is Pro or Ser; Xaa at position 45 is Glu or Leu; Xaa at position 46 is Ala or Ser; Xaa at position 48 is Asn, Val

or Pro; Xaa at position 49 is Arg or His; Xaa at position 51 is Val or Ser; Xaa at position 53 is Ser, Asn, His or Gln; Xaa at position 55 is Gln or Glu; Xaa at position 59 is Ala or Gly; Xaa at position 62 is Ser, Ala or Pro; Xaa  
5 at position 65 is Lys, Arg or Ser; Xaa at position 67 is Leu, Glu, or Val; Xaa at position 68 is Leu, Glu, Val or Trp; Xaa at position 71 is Leu or Val; Xaa at position 73 is Leu, Ser or Tyr; Xaa at position 74 is Ala or Trp; Xaa at position 77 is Ala or Pro; Xaa at position 79 is Pro  
10 or Ser; Xaa at position 81 is His or Thr; Xaa at position 84 is His, Ile, or Thr; Xaa at position 86 is Lys or Arg; Xaa at position 87 is Asp, Ala or Met; Xaa at position 91 is Asn or Glu; Xaa at position 95 is Arg, Glu, Leu; Xaa at position 98 Thr or Gln; Xaa at position 102 is Lys,  
15 Val, Trp or Ser; Xaa at position 103 is Thr or Ser; Xaa at position 106 is Asn, Gln, or His; Xaa at position 109 is Ala or Glu; with the proviso that from four to forty-four of the amino acids designated by Xaa are different from the corresponding amino acids of native (15-  
20 125)human interleukin-3; or a polypeptide having substantially the same structure and substantially the same biological activity.

21. A polypeptide according to Claim 20  
25 wherein Xaa at position 4 is Ile; Xaa at position 5 is Ala, or Ile; Xaa at position 6 is Pro, or Leu; Xaa at position 9 is Ala, or Leu; Xaa at position 11 is His; Xaa at position 15 is Arg or Val, or Ile; Xaa at position 18 is Ala or Asn, or Arg; Xaa at position 20 is Ser; Xaa at  
30 position 23 is Pro or Ser; Xaa at position 24 is Ala; Xaa at position 28 is Ala or Ser, or Asp, or Asn; Xaa at position 31 is Val or Met; and Xaa at position 32 is Ser.

22. A polypeptide according to Claim 20  
35 wherein Xaa at position 35 is Ile, or Leu, or Asp; Xaa at position 36 is Asp; Xaa at position 37 is Arg, or Ser; Xaa at position 41 is Leu or Thr; Xaa at position 42 is



Ser; Xaa at position 45 is Glu or Leu; Xaa at position 46 is Ala or Ser; Xaa at position 48 is Val, or Pro; Xaa at position 49 is His; Xaa at position 51 is Ser; Xaa at position 53 is Asn, or His, or Gln; and Xaa at position 55 is Glu.

23. A polypeptide according to Claim 20 wherein Xaa at position 59 is Gly; Xaa at position 62 is Ala, or Pro; Xaa at position 65 is Arg, or Ser; Xaa at position 67 is Gln or Val; Xaa at position 68 is Glu, or Val, or Trp; Xaa at position 71 is Val; Xaa at position 73 is Ser, or Tyr; Xaa at position 74 is Trp; Xaa at position 77 is Pro; Xaa at position 79 is Ser; Xaa at position 81 is Thr; Xaa at position 84 is Ile or Thr; Xaa at position 86 is Arg; Xaa at position 87 is Ala, or Met; and Xaa at position 91 is Glu.

24. A polypeptide according to Claim 20 wherein Xaa at position 95 is Glu, or Leu; Xaa at position 98 is Gln; Xaa at position 102 is Val, or Trp, or Ser; Xaa at position 103 is Ser; Xaa at position 106 is Glu or His; and Xaa at position 109 is Glu.

25. A polypeptide according to Claim 20 wherein Xaa at position 4 is Ile; Xaa at position 5 is Ala, or Ile; Xaa at position 6 is Pro, or Leu; Xaa at position 9 is Ala, or Leu; Xaa at position 11 is His; Xaa at position 15 is Arg or Val, or Ile; Xaa at position 18 is Ala or Asn, or Arg; Xaa at position 20 is Ser; Xaa at position 23 is Pro or Ser; Xaa at position 24 is Ala; Xaa at position 28 is Ala or Ser, or Asp, or Asn; Xaa at position 31 is Val or Met; Xaa at position 32 is Ser; Xaa at position 35 is Ile, or Leu, or Asp; Xaa at position 36 is Asp; Xaa at position 37 is Arg, or Ser; Xaa at position 41 is Leu or Thr; Xaa at position 42 is Ser; Xaa at position 45 is Glu or Leu; Xaa at position 46 is Ala or Ser; Xaa at position 48 is Val, or Pro; Xaa at

position 49 is His; Xaa at position 51 is Ser; Xaa at position 53 is Asn, or His, or Gln; and Xaa at position 55 is Glu.

5                   26. A polypeptide according to Claim 20  
 wherein Xaa at position 59 is Gly; Xaa at position 62 is  
 Ala, or Pro; Xaa at position 65 is Arg, or Ser; Xaa at  
 position 67 is Gln or Val; Xaa at position 68 is Glu, or  
 Val, or Trp; Xaa at position 71 is Val; Xaa at position  
 10 73 is Ser, or Tyr; Xaa at position 74 is Trp; Xaa at  
 position 77 is Pro; Xaa at position 79 is Ser; Xaa at  
 position 81 is Thr; Xaa at position 84 is Ile or Thr; Xaa  
 at position 86 is Arg; Xaa at position 87 is Ala, or Met;  
 Xaa at position 91 is Glu; Xaa at position 95 is Glu, or  
 15 Lue; Xaa at position 98 is Gln; Xaa at position 102 is  
 Val, or Trp, or Ser; Xaa at position 103 is Ser; Xaa at  
 position 106 is Glu or His; and Xaa at position 109 is  
 Glu.

20                   27. A polypeptide according to Claim 20 which  
 is selected from

Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His Leu  
 Lys Arg Pro Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu Asn  
 Ala  
 25 Glu Asp Val Asp Ile Leu Met Glu Asn Asn Leu Arg Arg Pro  
 Asn  
 Leu Glu Ala Phe Asn Arg Ala Val Lys Ser Leu Gln Asn Ala  
 Ser  
 Ala Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys Leu Pro  
 30 Leu  
 Ala Thr Ala Ala Pro Thr Arg His Pro Ile His Ile Lys Asp  
 Gly  
 Asp Trp Asn Glu Phe Arg Arg Lys Leu Thr Phe Tyr Leu Lys  
 Thr  
 35 Leu Glu Asn Ala Gln Ala Gln Gln [SEQ ID NO:66];

Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His Leu

Lys  
 Arg Pro Pro Asn Pro Leu Leu Asp Pro Asn Asn Leu Asn Ser  
 Glu  
 Asp Met Asp Ile Leu Met Glu Asn Asn Leu Arg Arg Pro Asn  
 5 Leu  
 Glu Ala Phe Asn Arg Ala Val Lys Ser Leu Gln Asn Ala Ser  
 Ala  
 Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys Leu Pro Leu  
 Ala  
 10 Thr Ala Ala Pro Thr Arg His Pro Ile His Ile Lys Asp Gly  
 Asp  
 Trp Asn Glu Phe Arg Arg Lys Leu Thr Phe Tyr Leu Lys Thr  
 Leu  
 Glu Asn Ala Gln Ala Gln Gln [SEQ ID NO:67];  
 15  
 Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His Leu  
 Lys  
 Val Pro Pro Ala Pro Leu Leu Asp Ser Asn Asn Leu Asn Ser  
 Glu  
 20 Asp Met Asp Ile Leu Met Glu Asn Asn Leu Arg Arg Pro Asn  
 Leu  
 Glu Ala Phe Asn Arg Ala Val Lys Ser Leu Gln Asn Ala Ser  
 Ala  
 Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys Leu Pro Leu  
 25 Ala  
 Thr Ala Ala Pro Thr Arg His Pro Ile His Ile Lys Asp Gly  
 Asp  
 Trp Asn Glu Phe Arg Arg Lys Leu Thr Phe Tyr Leu Lys Thr  
 Leu  
 30 Glu Asn Ala Gln Ala Gln Gln [SEQ ID NO:68];  
 Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His Leu  
 Lys  
 Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu Asn Gly  
 35 Glu  
 Asp Gln Asp Ile Leu Met Glu Arg Asn Leu Arg Leu Pro Asn  
 Leu

Leu Ala Phe Val Arg Ala Val Lys Asn Leu Glu Asn Ala Ser  
Ala  
Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys Leu Pro Leu  
Ala  
5 Thr Ala Ala Pro Thr Arg His Pro Ile His Ile Lys Asp Gly  
Asp  
Trp Asn Glu Phe Arg Arg Lys Leu Thr Phe Tyr Leu Lys Thr  
Leu  
Glu Asn Ala Gln Ala Gln Gln [SEQ ID NO:69];  
10  
Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His Leu  
Lys  
Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu Asn Gly  
Glu  
15 Asp Gln Asp Ile Leu Met Glu Arg Asn Leu Arg Leu Pro Asn  
Leu  
Glu Ser Phe Val Arg Ala Val Lys Asn Leu Glu Asn Ala Ser  
Ala  
Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys Leu Pro Leu  
20 Ala  
Thr Ala Ala Pro Thr Arg His Pro Ile His Ile Lys Asp Gly  
Asp  
Trp Asn Glu Phe Arg Arg Lys Leu Thr Phe Tyr Leu Lys Thr  
Leu  
25 Glu Asn Ala Gln Ala Gln Gln [SEQ ID NO:70];  
Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His Leu  
Lys  
Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu Asn Gly  
30 Glu  
Asp Gln Asp Ile Leu Met Glu Arg Asn Leu Arg Thr Pro Asn  
Leu  
Leu Ala Phe Val Arg Ala Val Lys His Leu Glu Asn Ala Ser  
Ala  
35 Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys Leu Pro Leu  
Ala  
Thr Ala Ala Pro Thr Arg His Pro Ile His Ile Lys Asp Gly

Asp

Trp Asn Glu Phe Arg Arg Lys Leu Thr Phe Tyr Leu Lys Thr  
Leu

Glu Asn Ala Gln Ala Gln Gln [SEQ ID NO:71];

5

Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His Leu  
Lys

Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu Asn Gly  
Glu

10 Asp Gln Asp Ile Leu Met Glu Asn Asn Leu Arg Arg Pro Asn  
Leu

Glu Ala Phe Asn Arg Ala Val Lys Ser Leu Gln Asn Ala Ser  
Gly

Ile Glu Ala Ile Leu Arg Asn Leu Gln Pro Cys Leu Pro Ser  
15 Ala

Thr Ala Ala Pro Ser Arg His Pro Ile Ile Ile Lys Ala Gly  
Asp

Trp Gln Glu Phe Arg Arg Lys Leu Thr Phe Tyr Leu Lys Thr  
Leu

20 Glu Asn Ala Gln Ala Gln Gln [SEQ ID NO:72];

Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His Leu  
Lys

Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu Asn Gly  
25 Glu

Asp Gln Asp Ile Leu Met Glu Asn Asn Leu Arg Arg Pro Asn  
Leu

Glu Ala Phe Asn Arg Ala Val Lys Ser Leu Gln Asn Ala Ser  
Gly

30 Ile Glu Ala Ile Leu Arg Asn Leu Val Pro Cys Leu Pro Ser  
Ala

Thr Ala Ala Pro Ser Arg His Pro Ile Thr Ile Lys Ala Gly  
Asp

Trp Gln Glu Phe Arg Arg Lys Leu Thr Phe Tyr Leu Lys Thr  
35 Leu

Glu Asn Ala Gln Ala Gln Gln [SEQ ID NO:73];

Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His Leu  
 Lys  
 Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu Asn Gly  
 Glu  
 5 Asp Gln Asp Ile Leu Met Glu Asn Asn Leu Arg Arg Pro Asn  
 Leu  
 Glu Ala Phe Asn Arg Ala Val Lys Ser Leu Gln Asn Ala Ser  
 Ala  
 Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys Leu Pro Leu  
 10 Ala  
 Thr Ala Ala Pro Thr Arg His Pro Ile His Ile Lys Asp Gly  
 Asp  
 Trp Asn Glu Phe Arg Glu Lys Leu Thr Phe Tyr Leu Val Thr  
 Leu  
 15 Glu Gln Ala Gln Glu Gln Gln [SEQ ID NO:74];

Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His Leu  
 Lys  
 Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu Asn Gly  
 20 Glu  
 Asp Gln Asp Ile Leu Met Glu Asn Asn Leu Arg Arg Pro Asn  
 Leu  
 Glu Ala Phe Asn Arg Ala Val Lys Ser Leu Gln Asn Ala Ser  
 Ala  
 25 Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys Leu Pro Leu  
 Ala  
 Thr Ala Ala Pro Thr Arg His Pro Ile His Ile Lys Asp Gly  
 Asp  
 Trp Asn Glu Phe Arg Glu Lys Leu Thr Phe Tyr Leu Val Ser  
 30 Leu  
 Glu His Ala Gln Glu Gln Gln [SEQ ID NO:75];

Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His Leu  
 Lys  
 35 Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu Asn Gly  
 Glu  
 Asp Gln Asp Ile Leu Met Glu Asn Asn Leu Arg Arg Pro Asn

Leu  
 Glu Ala Phe Asn Arg Ala Val Lys Ser Leu Gln Asn Ala Ser  
 Gly  
 Ile Glu Ala Ile Leu Arg Asn Leu Gln Pro Cys Leu Pro Ser  
 5 Ala  
 Thr Ala Ala Pro Ser Arg His Pro Ile Ile Ile Lys Ala Gly  
 Asp  
 Trp Gln Glu Phe Arg Glu Lys Leu Thr Phe Tyr Leu Val Thr  
 Leu  
 10 Glu Gln Ala Gln Glu Gln Gln [SEQ ID NO:76];  
  
 Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His Leu  
 Lys  
 Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu Asn Gly  
 15 Glu  
 Asp Gln Asp Ile Leu Met Glu Asn Asn Leu Arg Arg Pro Asn  
 Leu  
 Glu Ala Phe Asn Arg Ala Val Lys Ser Leu Gln Asn Ala Ser  
 Gly  
 20 Ile Glu Ala Ile Leu Arg Asn Leu Val Pro Cys Leu Pro Ser  
 Ala  
 Thr Ala Ala Pro Ser Arg His Pro Ile Thr Ile Lys Ala Gly  
 Asp  
 Trp Gln Glu Phe Arg Glu Lys Leu Thr Phe Tyr Leu Val Thr  
 25 Leu  
 Glu Gln Ala Gln Glu Gln Gln [SEQ ID NO:77];  
  
 Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His Leu  
 Lys  
 30 Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu Asn Gly  
 Glu  
 Asp Gln Asp Ile Leu Met Glu Asn Asn Leu Arg Arg Pro Asn  
 Leu  
 Glu Ala Phe Asn Arg Ala Val Lys Ser Leu Gln Asn Ala Ser  
 35 Gly  
 Ile Glu Ala Ile Leu Arg Asn Leu Val Pro Cys Leu Pro Ser  
 Ala

Thr Ala Ala Pro Ser Arg His Pro Ile Thr Ile Lys Ala Gly  
Asp  
Trp Gln Glu Phe Arg Glu Lys Leu Thr Phe Tyr Leu Val Ser  
Leu  
5 Glu His Ala Gln Glu Gln Gln [SEQ ID NO:78];

Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His Leu  
Lys  
Arg Pro Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu Asn Ala  
10 Glu  
Asp Val Asp Ile Leu Met Glu Arg Asn Leu Arg Leu Pro Asn  
Leu  
Glu Ser Phe Val Arg Ala Val Lys Asn Leu Glu Asn Ala Ser  
Ala  
15 Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys Leu Pro Leu  
Ala  
Thr Ala Ala Pro Thr Arg His Pro Ile His Ile Lys Asp Gly  
Asp  
Trp Asn Glu Phe Arg Arg Lys Leu Thr Phe Tyr Leu Lys Thr  
20 Leu  
Glu Asn Ala Gln Ala Gln Gln [SEQ ID NO:79];

Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His Leu  
Lys  
25 Arg Pro Pro Asn Pro Leu Leu Asp Pro Asn Asn Leu Asn Ser  
Glu  
Asp Met Asp Ile Leu Met Glu Arg Asn Leu Arg Thr Pro Asn  
Leu  
Leu Ala Phe Val Arg Ala Val Lys His Leu Glu Asn Ala Ser  
30 Ala  
Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys Leu Pro Leu  
Ala  
Thr Ala Ala Pro Thr Arg His Pro Ile His Ile Lys Asp Gly  
Asp  
35 Trp Asn Glu Phe Arg Arg Lys Leu Thr Phe Tyr Leu Lys Thr  
Leu  
Glu Asn Ala Gln Ala Gln Gln [SEQ ID NO:80];



Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His Leu  
 Lys  
 Val Pro Pro Ala Pro Leu Leu Asp Ser Asn Asn Leu Asn Ser  
 5 Glu  
 Asp Met Asp Ile Leu Met Glu Arg Asn Leu Arg Leu Pro Asn  
 Leu  
 Leu Ala Phe Val Arg Ala Val Lys Asn Leu Glu Asn Ala Ser  
 Ala  
 10 Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys Leu Pro Leu  
 Ala  
 Thr Ala Ala Pro Thr Arg His Pro Ile His Ile Lys Asp Gly  
 Asp  
 Trp Asn Glu Phe Arg Arg Lys Leu Thr Phe Tyr Leu Lys Thr  
 15 Leu  
 Glu Asn Ala Gln Ala Gln Gln [SEQ ID NO:81];  
  
 Met Ala Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His  
 Leu  
 20 Lys Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu Asn  
 Gly  
 Glu Asp Gln Asp Ile Leu Met Glu Asn Asn Leu Arg Arg Pro  
 Asn  
 Leu Glu Ala Phe Asn Arg Ala Val Lys Ser Leu Gln Asn Ala  
 25 Ser  
 Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln Pro Cys Leu Pro  
 Ser  
 Ala Thr Ala Ala Pro Ser Arg His Pro Ile Ile Ile Lys Ala  
 Gly  
 30 Asp Trp Gln Glu Phe Arg Glu Lys Leu Thr Phe Tyr Leu Val  
 Thr  
 Leu Glu Gln Ala Gln Glu Gln Gln [SEQ ID NO:82];  
  
 Met Ala Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His  
 35 Leu  
 Lys Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu Asn  
 Gly

Glu Asp Gln Asp Ile Leu Met Glu Asn Asn Leu Arg Arg Pro  
Asn  
Leu Glu Ala Phe Asn Arg Ala Val Lys Ser Leu Gln Asn Ala  
Ser  
5 Gly Ile Glu Ala Ile Leu Arg Asn Leu Val Pro Cys Leu Pro  
Ser  
Ala Thr Ala Ala Pro Ser Arg His Pro Ile Thr Ile Lys Ala  
Gly  
Asp Trp Gln Glu Phe Arg Glu Lys Leu Thr Phe Tyr Leu Val  
10 Thr  
Leu Glu Gln Ala Gln Glu Gln Gln [SEQ ID NO:83];

Met Ala Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr His  
Leu  
15 Lys Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn Asn Leu Asn  
Gly  
Glu Asp Gln Asp Ile Leu Met Glu Asn Asn Leu Arg Arg Pro  
Asn  
Leu Glu Ala Phe Asn Arg Ala Val Lys Ser Leu Gln Asn Ala  
20 Ser  
Gly Ile Glu Ala Ile Leu Arg Asn Leu Val Pro Cys Leu Pro  
Ser  
Ala Thr Ala Ala Pro Ser Arg His Pro Ile Thr Ile Lys Ala  
Gly  
25 Asp Trp Gln Glu Phe Arg Glu Lys Leu Thr Phe Tyr Leu Val  
Ser  
Leu Glu His Ala Gln Glu Gln Gln [SEQ ID NO:84];

Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His  
30 Leu  
Lys Arg Pro Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu Asn  
Ala  
Glu Asp Val Asp Ile Leu Met Glu Arg Asn Leu Arg Leu Pro  
Asn  
35 Leu Glu Ser Phe Val Arg Ala Val Lys Asn Leu Glu Asn Ala  
Ser  
Ala Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys Leu Pro

Leu  
 Ala Thr Ala Ala Pro Thr Arg His Pro Ile His Ile Lys Asp  
 Gly  
 Asp Trp Asn Glu Phe Arg Arg Lys Leu Thr Phe Tyr Leu Lys  
 5 Thr  
 Leu Glu Asn Ala Gln Ala Gln Gln [SEQ ID NO:85];  
  
 Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His  
 Leu  
 10 Lys Arg Pro Pro Asn Pro Leu Leu Asp Pro Asn Asn Leu Asn  
 Ser  
 Glu Asp Met Asp Ile Leu Met Glu Arg Asn Leu Arg Thr Pro  
 Asn  
 Leu Leu Ala Phe Val Arg Ala Val Lys His Leu Glu Asn Ala  
 15 Ser  
 Ala Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys Leu Pro  
 Leu  
 Ala Thr Ala Ala Pro Thr Arg His Pro Ile His Ile Lys Asp  
 Gly  
 20 Asp Trp Asn Glu Phe Arg Arg Lys Leu Thr Phe Tyr Leu Lys  
 Thr  
 Leu Glu Asn Ala Gln Ala Gln Gln [SEQ ID NO:86];  
  
 Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His  
 25 Leu  
 Lys Val Pro Pro Ala Pro Leu Leu Asp Ser Asn Asn Leu Asn  
 Ser  
 Glu Asp Met Asp Ile Leu Met Glu Arg Asn Leu Arg Leu Pro  
 Asn  
 30 Leu Leu Ala Phe Val Arg Ala Val Lys Asn Leu Glu Asn Ala  
 Ser  
 Ala Ile Glu Ser Ile Leu Lys Asn Leu Leu Pro Cys Leu Pro  
 Leu  
 Ala Thr Ala Ala Pro Thr Arg His Pro Ile His Ile Lys Asp  
 35 Gly  
 Asp Trp Asn Glu Phe Arg Arg Lys Leu Thr Phe Tyr Leu Lys  
 Thr

Leu Glu Asn Ala Gln Ala Gln Gln [SEQ ID NO:87];

Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His  
Leu

5 Lys Arg Pro Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu Asn  
Ala

Glu Asp Val Asp Ile Leu Met Glu Arg Asn Leu Arg Leu Pro  
Asn

10 Leu Glu Ser Phe Val Arg Ala Val Lys Asn Leu Glu Asn Ala  
Ser

Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln Pro Cys Leu Pro  
Ser

Ala Thr Ala Ala Pro Ser Arg His Pro Ile Ile Ile Lys Ala  
Gly

15 Asp Trp Gln Glu Phe Arg Glu Lys Leu Thr Phe Tyr Leu Val  
Thr

Leu Glu Gln Ala Gln Glu Gln Gln [SEQ ID NO:88];

20 Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His  
Leu

Lys Arg Pro Pro Asn Pro Leu Leu Asp Pro Asn Asn Leu Asn  
Ser

Glu Asp Met Asp Ile Leu Met Glu Arg Asn Leu Arg Thr Pro  
Asn

25 Leu Leu Ala Phe Val Arg Ala Val Lys His Leu Glu Asn Ala  
Ser

Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln Pro Cys Leu Pro  
Ser

30 Ala Thr Ala Ala Pro Ser Arg His Pro Ile Ile Ile Lys Ala  
Gly

Asp Trp Gln Glu Phe Arg Glu Lys Leu Thr Phe Tyr Leu Val  
Thr

Leu Glu Gln Ala Gln Glu Gln Gln [SEQ ID NO:89];

35 Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His  
Leu

Lys Val Pro Pro Ala Pro Leu Leu Asp Ser Asn Asn Leu Asn

Ser  
 Glu Asp Met Asp Ile Leu Met Glu Arg Asn Leu Arg Leu Pro  
 Asn  
 Leu Leu Ala Phe Val Arg Ala Val Lys Asn Leu Glu Asn Ala  
 5 Ser  
 Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln Pro Cys Leu Pro  
 Ser  
 Ala Thr Ala Ala Pro Ser Arg His Pro Ile Ile Ile Lys Ala  
 Gly  
 10 Asp Trp Gln Glu Phe Arg Glu Lys Leu Thr Phe Tyr Leu Val  
 Thr  
 Leu Glu Gln Ala Gln Glu Gln Gln [SEQ ID NO:90];  
  
 Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His  
 15 Leu  
 Lys Arg Pro Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu Asn  
 Ala  
 Glu Asp Val Asp Ile Leu Met Glu Arg Asn Leu Arg Leu Pro  
 Asn  
 20 Leu Glu Ser Phe Val Arg Ala Val Lys Asn Leu Glu Asn Ala  
 Ser  
 Gly Ile Glu Ala Ile Leu Arg Asn Leu Val Pro Cys Leu Pro  
 Ser  
 Ala Thr Ala Ala Pro Ser Arg His Pro Ile Thr Ile Lys Ala  
 25 Gly  
 Asp Trp Gln Glu Phe Arg Glu Lys Leu Thr Phe Tyr Leu Val  
 Thr  
 Leu Glu Gln Ala Gln Glu Gln Gln [SEQ ID NO:91];  
  
 30 Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His  
 Leu  
 Lys Val Pro Pro Ala Pro Leu Leu Asp Ser Asn Asn Leu Asn  
 Ser  
 Glu Asp Met Asp Ile Leu Met Glu Arg Asn Leu Arg Leu Pro  
 35 Asn  
 Leu Leu Ala Phe Val Arg Ala Val Lys Asn Leu Glu Asn Ala  
 Ser

Gly Ile Glu Ala Ile Leu Arg Asn Leu Val Pro Cys Leu Pro  
 Ser  
 Ala Thr Ala Ala Pro Ser Arg His Pro Ile Thr Ile Lys Ala  
 Gly  
 5 Asp Trp Gln Glu Phe Arg Glu Lys Leu Thr Phe Tyr Leu Val  
 Thr  
 Leu Glu Gln Ala Gln Glu Gln Gln [SEQ ID NO:92];  
  
 Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His  
 10 Leu  
 Lys Arg Pro Pro Asn Pro Leu Leu Asp Pro Asn Asn Leu Asn  
 Ser  
 Glu Asp Met Asp Ile Leu Met Glu Arg Asn Leu Arg Thr Pro  
 Asn  
 15 Leu Leu Ala Phe Val Arg Ala Val Lys His Leu Glu Asn Ala  
 Ser  
 Gly Ile Glu Ala Ile Leu Arg Asn Leu Val Pro Cys Leu Pro  
 Ser  
 Ala Thr Ala Ala Pro Ser Arg His Pro Ile Thr Ile Lys Ala  
 20 Gly  
 Asp Trp Gln Glu Phe Arg Glu Lys Leu Thr Phe Tyr Leu Val  
 Ser  
 Leu Glu His Ala Gln Glu Gln Gln [SEQ ID NO:93];  
  
 25 Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His  
 Leu  
 Lys Val Pro Pro Ala Pro Leu Leu Asp Ser Asn Asn Leu Asn  
 Ser  
 Glu Asp Met Asp Ile Leu Met Glu Arg Asn Leu Arg Leu Pro  
 30 Asn  
 Leu Leu Ala Phe Val Arg Ala Val Lys Asn Leu Glu Asn Ala  
 Ser  
 Gly Ile Glu Ala Ile Leu Arg Asn Leu Val Pro Cys Leu Pro  
 Ser  
 35 Ala Thr Ala Ala Pro Ser Arg His Pro Ile Thr Ile Lys Ala  
 Gly  
 Asp Trp Gln Glu Phe Arg Glu Lys Leu Thr Phe Tyr Leu Val

Ser  
 Leu Glu His Ala Gln Glu Gln Gln [SEQ ID NO:94];  
  
 Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His  
 5 Leu  
 Lys Arg Pro Pro Asn Pro Leu Leu Asp Pro Asn Asn Leu Asn  
 Ser  
 Glu Asp Met Asp Ile Leu Met Glu Arg Asn Leu Arg Thr Pro  
 Asn  
 10 Leu Leu Ala Phe Val Arg Ala Val Lys His Leu Glu Asn Ala  
 Ser  
 Gly Ile Glu Ala Ile Leu Arg Asn Leu Val Pro Cys Leu Pro  
 Ser  
 Ala Thr Ala Ala Pro Ser Arg His Pro Ile Thr Ile Lys Ala  
 15 Gly  
 Asp Trp Gln Glu Phe Arg Glu Lys Leu Thr Phe Tyr Leu Val  
 Thr  
 Leu Glu Gln Ala Gln Glu Gln Gln [SEQ ID NO:95]; and  
  
 20 Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His  
 Leu  
 Lys Arg Pro Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu Asn  
 Ala  
 Glu Asp Val Asp Ile Leu Met Glu Arg Asn Leu Arg Leu Pro  
 25 Asn  
 Leu Glu Ser Phe Val Arg Ala Val Lys Asn Leu Glu Asn Ala  
 Ser  
 Gly Ile Glu Ala Ile Leu Arg Asn Leu Val Pro Cys Leu Pro  
 Ser  
 30 Ala Thr Ala Ala Pro Ser Arg His Pro Ile Thr Ile Lys Ala  
 Gly  
 Asp Trp Gln Glu Phe Arg Glu Lys Leu Thr Phe Tyr Leu Val  
 Ser  
 Leu Glu His Ala Gln Glu Gln Gln [SEQ ID NO:96].  
 35  
 Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His  
 Leu  
 40 Lys Arg Pro Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu Asn

Ala

5 Glu Asp Val Asp Ile Leu Met Asp Arg Asn Leu Arg Leu Ser  
Asn

10 Leu Glu Ser Phe Val Arg Ala Val Lys Asn Leu Glu Asn Ala  
Ser

15 Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln Pro Cys Leu Pro  
Ser

Ala Thr Ala Ala Pro Ser Arg His Pro Ile Ile Ile Lys Ala  
Gly

20 Asp Trp Gln Glu Phe Arg Glu Lys Leu Thr Phe Tyr Leu Val  
Thr

Leu Glu Gln Ala Gln Glu Gln Gln [SEQ ID NO.: 296]

25 Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ala Ile His His  
Leu

Lys Arg Pro Pro Ala Pro Ser Leu Asp Pro Asn Asn Leu Asn  
Asp

30 Glu Asp Met Ser Ile Leu Met Glu Arg Asn Leu Arg Leu Pro  
Asn

Leu Glu Ser Phe Val Arg Ala Val Lys Asn Leu Glu Asn Ala  
Ser

35 Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln Pro Cys Leu Pro  
Ser

40 Ala Thr Ala Ala Pro Ser Arg His Pro Ile Ile Ile Lys Ala  
Gly

Asp Trp Gln Glu Phe Arg Glu Lys Leu Thr Phe Tyr Leu Val  
Thr

45 Leu Glu Gln Ala Gln Glu Gln Gln [SEQ ID NO.: 300]

Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His  
Leu

50 Lys Arg Pro Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu Asn  
Asp

Glu Asp Met Ser Ile Leu Met Glu Arg Asn Leu Arg Leu Pro  
Asn

55 Leu Glu Ser Phe Val Arg Ala Val Lys Asn Leu Glu Asn Ala  
Ser



Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln Pro Cys Leu Pro  
 Ser  
 5 Ala Thr Ala Ala Pro Ser Arg His Pro Ile Ile Ile Lys Ala  
 Gly  
 Asp Trp Gln Glu Phe Arg Glu Lys Leu Thr Phe Tyr Leu Val  
 Thr  
 10 Leu Glu Gln Ala Gln Glu Gln Gln [SEQ ID NO.: 301]  
 Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His  
 Leu  
 15 Lys Arg Pro Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu Asn  
 Ala  
 Glu Asp Val Asp Ile Leu Met Asp Arg Asn Leu Arg Leu Pro  
 20 Asn  
 Leu Glu Ser Phe Val Arg Ala Val Lys Asn Leu Glu Asn Ala  
 Ser  
 25 Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln Pro Cys Leu Pro  
 Ser  
 Ala Thr Ala Ala Pro Ser Arg His Pro Ile Ile Ile Lys Ala  
 Gly  
 30 Asp Trp Gln Glu Phe Arg Glu Lys Leu Thr Phe Tyr Leu Val  
 Thr  
 Leu Glu Gln Ala Gln Glu Gln Gln [SEQ ID NO.: 308]  
 35 Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His  
 Leu  
 40 Lys Arg Pro Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu Asn  
 Asp  
 Glu Asp Val Ser Ile Leu Met Glu Arg Asn Leu Arg Leu Pro  
 Asn  
 45 Leu Glu Ser Phe Val Arg Ala Val Lys Asn Leu Glu Asn Ala  
 Ser  
 Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln Pro Cys Leu Pro  
 50 Ser  
 Ala Thr Ala Ala Pro Ser Arg His Pro Ile Ile Ile Lys Ala  
 Gly  
 55 Asp Trp Gln Glu Phe Arg Glu Lys Leu Thr Phe Tyr Leu Val

Thr

Leu Glu Gln Ala Gln Glu Gln Gln [SEQ ID NO.: 309]

5

Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His  
Leu

10

Lys Arg Pro Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu Asn  
Asp

Glu Asp Met Ser Ile Leu Met Glu Arg Asn Leu Arg Leu Pro  
Asn

15

Leu Glu Ser Phe Val Arg Ala Val Lys Asn Leu Glu Asn Ala  
Ser

Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln Pro Cys Leu Pro  
Ser

20

Ala Thr Ala Ala Pro Ser Arg His Pro Ile Ile Ile Lys Ala  
Gly

25

Asp Trp Gln Glu Phe Arg Glu Lys Leu Thr Phe Tyr Leu Val  
Thr

Leu Glu Gln Ala Gln Glu Gln Gln [SEQ ID NO.: 310]

30

Met Ala Tyr Pro Glu Thr Asp Tyr Lys Asp Asp Asp Asp Lys  
Asn

Cys Ser Ile Met Ile Asp Glu Ile Ile His His Leu Lys Arg  
Pro

35

Pro Ala Pro Leu Leu Asp Pro Asn Asn Leu Asn Ala Glu Asp  
Val

Asp Ile Leu Met Glu Arg Asn Leu Arg Leu Pro Asn Leu Glu  
Ser

40

Phe Val Arg Ala Val Lys Asn Leu Glu Asn Ala Ser Gly Ile  
Glu

45

Ala Ile Leu Arg Asn Leu Gln Pro Cys Leu Pro Ser Ala Thr  
Ala

Ala Pro Ser Arg His Pro Ile Ile Ile Lys Ala Gly Asp Trp  
Gln

50

Glu Phe Arg Glu Lys Leu Thr Phe Tyr Leu Val Thr Leu Glu  
Gln

Ala Gln Glu Gln Gln [SEQ ID NO.: 315]

55

Met Ala Tyr Pro Glu Thr Asp Tyr Lys Asp Asp Asp Asp Lys  
Asn

5 Cys Ser Ile Met Ile Asp Glu Ile Ile His His Leu Lys Arg  
Pro

Pro Asn Pro Leu Leu Asp Pro Asn Asn Leu Asn Ser Glu Asp  
Met

10 Asp Ile Leu Met Glu Arg Asn Leu Arg Thr Pro Asn Leu Leu  
Ala

Phe Val Arg Ala Val Lys His Leu Glu Asn Ala Ser Gly Ile  
Glu

15 Ala Ile Leu Arg Asn Leu Gln Pro Cys Leu Pro Ser Ala Thr  
Ala

Ala Pro Ser Arg His Pro Ile Ile Ile Lys Ala Gly Asp Trp  
20 Gln

Glu Phe Arg Glu Lys Leu Thr Phe Tyr Leu Val Thr Leu Glu  
Gln

25 Ala Gln Glu Gln Gln [SEQ ID NO.: 316]

Met Ala Asn Cys Ser Ile Met Ile Asp Glu Leu Ile His His  
Leu

30 Lys Ile Pro Pro Asn Pro Ser Leu Asp Ser Ala Asn Leu Asn  
Ser

Glu Asp Val Ser Ile Leu Met Glu Arg Asn Leu Arg Thr Pro  
Asn

35 Leu Leu Ala Phe Val Arg Ala Val Lys His Leu Glu Asn Ala  
Ser

Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln Pro Cys Leu Pro  
40 Ser

Ala Thr Ala Ala Pro Ser Arg His Pro Ile Ile Ile Lys Ala  
Gly

45 Asp Trp Gln Glu Phe Arg Glu Lys Leu Thr Phe Tyr Leu Val  
Thr

Leu Glu Gln Ala Gln Glu Gln Gln [SEQ ID NO.: 318]

50 28. A pharmaceutical composition for the  
treatment of hematopoietic cell deficiencies comprising a  
therapeutically effective amount of a mutant human

interleukin-3 polypeptide selected from the group consisting of a polypeptide of claim 1, a polypeptide of claim 2, a polypeptide of claim 3, a polypeptide of claim 4, a polypeptide of claim 5, a polypeptide of claim 6, a  
5 polypeptide of claim 7, a polypeptide of claim 8, a polypeptide of claim 9, a polypeptide of claim 10, a polypeptide of claim 11, a polypeptide of claim 12, a polypeptide of claim 13, a polypeptide of claim 14, a polypeptide of claim 15, a polypeptide of claim 16, a  
10 polypeptide of claim 17; a polypeptide of claim 18, a polypeptide of claim 19, a polypeptide of claim 20, a polypeptide of claim 21, a polypeptide of claim 22, a polypeptide of claim 23, a polypeptide of claim 24, a polypeptide of claim 25, a polypeptide of claim 26 and a  
15 polypeptide of claim 27, and a pharmaceutically acceptable carrier.

29. A pharmaceutical composition according to  
20 Claim 28 for the treatment of hematopoietic cell deficiencies comprising a therapeutically effective amount of a polypeptide having an amino acid sequence corresponding to SEQ ID NO:88 and a pharmaceutically acceptable carrier.

25

30. A pharmaceutical composition according to  
Claim 28 for the treatment of hematopoietic cell deficiencies comprising a therapeutically effective amount of a polypeptide having an amino acid sequence  
30 corresponding to SEQ ID NO:89 and a pharmaceutically acceptable carrier.

31. A pharmaceutical composition according to  
Claim 28 for the treatment of hematopoietic cell  
35 deficiencies comprising a therapeutically effective amount of a polypeptide having an amino acid sequence corresponding to SEQ ID NO:90 and a pharmaceutically acceptable carrier.

acceptable carrier.

32. A pharmaceutical composition according to  
Claim 28 for the treatment of hematopoietic cell  
5 deficiencies comprising a therapeutically effective  
amount of a polypeptide selected from the group  
consisting of

10 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:66;

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:67;

15 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:68;

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:69;

20

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:70;

5 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:71;

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:72;

10 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:73;

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:74;

15 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:75;

20 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:76;

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:77;

25 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:78;

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:79;

30 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:80;

35 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:81;

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:82;

5 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:83;

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:84;

10 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:85;

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:86;

15 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:87;

20 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:91;

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:92;

25 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:93;

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:94;

30 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:95;

35 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:96;

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:258;

5 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:259;

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:260;

10 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:261;

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:262;

15 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:263;

20 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:278;

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:279;

25 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:314;

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:315;

30 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:316;

35 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:264;



a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:265;

5

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:266;

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:267;

10

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:268;

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:269;

15

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:270;

20

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:271;

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:272;

25

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:273;

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:274;

30

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:275;

35

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:276;

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:277;

5 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:280;

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:281;

10 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:282;

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:283;

15 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:284;

20 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:285;

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:286;

25 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:287;

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:288;

30 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:289;

35 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:299;

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:300;

5

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:301;

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:302;

10

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:303;

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:304;

15

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:305;

20

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:306;

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:307;

25

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:308;

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:309;

30

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:310;

35

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:311;

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:312;

5 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:313;

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:314;

10 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:317;

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:318;

15 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:319;

a polypeptide having an amino acid sequence corresponding to  
20 SEQ ID NO:320;

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:321;

25 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:322;

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:323;

30 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:324;

a polypeptide having an amino acid sequence corresponding to  
35 SEQ ID NO:325;

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:326;

and a pharmaceutically acceptable carrier.

5

33. A method of stimulating the production of  
hematopoietic cells which comprises administering a  
therapeutically effective amount of a mutant human  
interleukin-3 polypeptide selected from the group consisting of a  
10 polypeptide of claim 1, a polypeptide of claim 2, a polypeptide of  
claim 3, a polypeptide of claim 4, a polypeptide of claim 5, a  
polypeptide of claim 6, a polypeptide of claim 7, a polypeptide of  
claim 8, a polypeptide of claim 9, a polypeptide of claim 10, a  
polypeptide of claim 11, a polypeptide of claim 12, a polypeptide  
15 of claim 13, a polypeptide of claim 14, a polypeptide of claim 15,  
a polypeptide of claim 16, a polypeptide of claim 17; a polypeptide  
of claim 18, a polypeptide of claim 19, a polypeptide of claim 20,  
a polypeptide of claim 21, a polypeptide of claim 22, a polypeptide  
of claim 23, a polypeptide of claim 24, a polypeptide of claim 25,  
20 a polypeptide of claim 26, a polypeptide of claim 27, to a  
patient in need of such treatment.

34. A method according to claim 33 of  
stimulating the production of hematopoietic cells which  
25 comprises administering a therapeutically effective  
amount of a polypeptide having an amino acid sequence  
corresponding to SEQ ID NO:88.

35. A method according to claim 33 of  
30 stimulating the production of hematopoietic cells which  
comprises administering a therapeutically effective  
amount of a polypeptide having an amino acid sequence  
corresponding to SEQ ID NO:89.

36. A method according to claim 33 of  
35 stimulating the production of hematopoietic cells which  
comprises administering a therapeutically effective

amount of a polypeptide having an amino acid sequence corresponding to SEQ ID NO:90.

37. A method according to claim 33 of
- 5 stimulating the production of hematopoietic cells which comprises administering a therapeutically effective amount of a polypeptide selected from the group consisting of
- 10 a polypeptide having an amino acid sequence corresponding to SEQ ID NO:66;
- a polypeptide having an amino acid sequence corresponding to SEQ ID NO:67;
- 15 a polypeptide having an amino acid sequence corresponding to SEQ ID NO:68;
- a polypeptide having an amino acid sequence corresponding to SEQ ID NO:69;
- 20 a polypeptide having an amino acid sequence corresponding to SEQ ID NO:70;
- 25 a polypeptide having an amino acid sequence corresponding to SEQ ID NO:71;
- a polypeptide having an amino acid sequence corresponding to SEQ ID NO:72;
- 30 a polypeptide having an amino acid sequence corresponding to SEQ ID NO:73;
- a polypeptide having an amino acid sequence corresponding to SEQ ID NO:74;
- 35 a polypeptide having an amino acid sequence corresponding to

SEQ ID NO:75;

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:76;

5

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:77;

10

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:78;

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:79;

15

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:80;

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:81;

20

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:82;

25

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:83;

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:84;

30

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:85;

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:86;

35

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:87;

- a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:91;
- 5 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:92;
- a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:93;
- 10 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:94;
- a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:95;
- 15 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:96;
- a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:258;
- 20 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:259;
- 25 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:260;
- a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:261;
- 30 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:262;
- a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:263;
- 35



a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:278;

5 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:279;

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:314;

10 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:315;

15 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:316;

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:264;

20 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:265;

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:266;

25 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:267;

30 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:268;

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:269;

35 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:270;

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:271;

5 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:272;

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:273;

10 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:274;

15 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:275;

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:276;

20 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:277;

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:280;

25 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:281;

30 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:282;

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:283;

35 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:284;

- a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:285;
- 5 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:286;
- a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:287;
- 10 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:288;
- a polypeptide having an amino acid sequence corresponding to  
15 SEQ ID NO:289;
- a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:299;
- 20 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:300;
- a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:301;
- 25 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:302;
- a polypeptide having an amino acid sequence corresponding to  
30 SEQ ID NO:303;
- a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:304;
- 35 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:305;

- a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:306;
- 5 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:307;
- a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:308;
- 10 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:309;
- a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:310;
- 15 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:311;
- a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:312;
- 20 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:313;
- 25 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:314;
- a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:317;
- 30 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:318;
- 35 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:319;

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:320;

5 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:321;

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:322;

10 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:323;

15 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:324;

a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:325;

20 a polypeptide having an amino acid sequence corresponding to  
SEQ ID NO:326;

to a patient in need of such treatment.

25 38. A recombinant DNA sequence comprising  
vector DNA and a DNA that encodes a polypeptide selected from  
the group consisting of a polypeptide of claim 1, a polypeptide of  
claim 2, a polypeptide of claim 3, a polypeptide of claim 4, a  
polypeptide of claim 5, a polypeptide of claim 6, a polypeptide of  
30 claim 7, a polypeptide of claim 8, a polypeptide of claim 9, a  
polypeptide of claim 10, a polypeptide of claim 11, a polypeptide  
of claim 12, a polypeptide of claim 13, a polypeptide of claim 14,  
a polypeptide of claim 15, a polypeptide of claim 16, a polypeptide  
of claim 17; a polypeptide of claim 18, a polypeptide of claim 19,  
35 a polypeptide of claim 20, a polypeptide of claim 21, a polypeptide  
of claim 22, a polypeptide of claim 23, a polypeptide of claim 24,  
a polypeptide of claim 25, a polypeptide of claim 26, or a

polypeptide of claim 27,.

39. A recombinant DNA sequence according to  
Claim 38 comprising vector DNA and a DNA having a  
5 nucleotide sequence corresponding to SEQ ID NO:97.

40. A recombinant DNA sequence according to  
Claim 38 comprising vector DNA and a DNA having a  
nucleotide sequence corresponding to SEQ ID NO:100 or  
10 103.

41. A recombinant DNA sequence according to  
Claim 38 comprising vector DNA and a DNA having a  
nucleotide sequence corresponding to SEQ ID NO:161.  
15

42. A recombinant DNA sequence according to  
Claim 38 comprising vector DNA and a DNA selected from

a DNA having a nucleotide sequence corresponding to SEQ ID  
20 NO:98;

a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:99;

25 a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:101;

a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:102;

30 a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:104;

35 a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:105;

a DNA having a nucleotide sequence corresponding to SEQ ID

NO:106;

5 a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:107;

a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:108;

10 a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:109;

a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:110;

15 a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:111;

20 a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:112;

a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:113;

25 a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:114;

a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:115;

30 a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:116;

35 a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:117;

a DNA having a nucleotide sequence corresponding to SEQ ID

NO:118;

5 a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:119;

a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:120;

10 a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:121;

a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:122;

15 a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:123;

20 a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:124;

a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:125;

25 a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:126;

a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:127;

30 a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:160;

35 a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:161;

a DNA having a nucleotide sequence corresponding to SEQ ID



NO:398;

5

a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:399;

a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:346;

10

a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:347

a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:303

15

a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:404

20

a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:405

a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:332

25

a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:333

a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:334

30

a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:335

35

a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:336

a DNA having a nucleotide sequence corresponding to SEQ ID

NO:337

5 a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:338

a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:339

10 a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:340

a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:341

15 a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:342

20 a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:343

a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:344

25 a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:345

a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:348

30 a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:349

35 a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:350

a DNA having a nucleotide sequence corresponding to SEQ ID

NO:352

5 a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:353

a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:354

10 a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:355

15 a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:356

a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:357

20 a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:358

a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:359

25 a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:360

30 a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:361

a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:362

35 a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:363

a DNA having a nucleotide sequence corresponding to SEQ ID

NO:364

5 a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:365

a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:366

10 a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:367

a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:368

15 a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:369

20 a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:370

a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:371

25 a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:372

a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:373

30 a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:374

35 a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:375

a DNA having a nucleotide sequence corresponding to SEQ ID

NO:376

5

a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:377

a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:378

10

a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:379

a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:380

15

a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:381

20

a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:382

a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:384

25

a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:385

a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:386

30

a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:387

35

a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:388

a DNA having a nucleotide sequence corresponding to SEQ ID

NO:389

5 a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:390

a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:391

10 a DNA having a nucleotide sequence corresponding to SEQ ID  
NO:392

15 43. A host cell containing a recombinant DNA  
sequence of claim 38 and capable of expressing the  
encoded polypeptide.

20 44. A host cell of claim 43 containing a  
recombinant DNA vector comprising vector DNA and a DNA  
having a nucleotide sequence corresponding to SEQ ID  
NO:97 and capable of expressing the encoded polypeptide.

25 45. A host cell of claim 43 containing a  
recombinant DNA vector comprising vector DNA and a DNA  
having a nucleotide sequence corresponding to SEQ ID  
NO:100 or 103 and capable of expressing the encoded  
polypeptide.

30 46. A host cell of claim 43 containing a  
recombinant DNA vector comprising vector DNA and a DNA  
having a nucleotide sequence corresponding to SEQ ID  
NO:161 and capable of expressing the encoded polypeptide.

35 47. A method of producing a mutant human  
interleukin-3 polypeptide comprising the steps of:

(a) culturing a host cell containing a recombinant

DNA sequence comprising vector DNA and a DNA sequence of Claim 38 and capable of expressing the encoded polypeptide under conditions permitting expression of the recombinant DNA; and

5

(b) harvesting the polypeptide from the culture.

48. A method according to Claim 47 of producing a mutant human interleukin-3 polypeptide comprising the steps of:

10

(a) culturing a host cell containing a recombinant DNA sequence comprising vector DNA and a DNA having a nucleotide sequence corresponding to SEQ ID NO:97 and capable of expressing the encoded polypeptide under conditions permitting expression of the recombinant DNA; and

15

(b) harvesting the polypeptide from the culture.

20

49. A method according to Claim 47 of producing a mutant human interleukin-3 polypeptide comprising the steps of:

(a) culturing a host cell containing a recombinant DNA sequence comprising vector DNA and a DNA having a nucleotide sequence corresponding to SEQ ID NO:100 or 103 and capable of expressing the encoded polypeptide under conditions permitting expression of the recombinant DNA; and

25

30

(b) harvesting the polypeptide from the culture.

50. A method according to Claim 47 of producing a mutant human interleukin-3 polypeptide comprising the steps of:

35

(a) culturing a host cell containing a recombinant DNA sequence comprising vector DNA and a DNA having a nucleotide sequence corresponding to SEQ ID NO:161 and capable of expressing the encoded polypeptide under conditions permitting expression of the recombinant DNA; and

(b) harvesting the polypeptide from the culture.

51. A vector containing a gene having a DNA sequence selected from the group consisting of:

a DNA having a nucleotide sequence corresponding to SEQ ID NO:97;

a DNA having a nucleotide sequence corresponding to SEQ ID NO:100;

a DNA having a nucleotide sequence corresponding to SEQ ID NO:103;

a DNA having a nucleotide sequence corresponding to SEQ ID NO:160;

a DNA having a nucleotide sequence corresponding to SEQ ID NO:161;

a DNA having a nucleotide sequence corresponding to SEQ ID NO:404;

a DNA having a nucleotide sequence corresponding to SEQ ID NO:405;

a DNA having a nucleotide sequence corresponding to SEQ ID NO:364;



a DNA having a nucleotide sequence corresponding to  
SEQ ID NO:368;

5 a DNA having a nucleotide sequence corresponding to  
SEQ ID NO:369;

a DNA having a nucleotide sequence corresponding to  
SEQ ID NO:376;

10 a DNA having a nucleotide sequence corresponding to  
SEQ ID NO:377;

15 a DNA having a nucleotide sequence corresponding to  
SEQ ID NO:378;

a DNA having a nucleotide sequence corresponding to  
SEQ ID NO:385;

20

52. A recombinant DNA vector comprising a  
promoter, a ribosome binding site, and a signal peptide  
directly linked to a DNA sequence encoding a polypeptide  
selected from the group consisting of

25 a polypeptide having an amino acid sequence  
corresponding to SEQ ID NO:88;

30 a polypeptide having an amino acid sequence  
corresponding to SEQ ID NO:89; and

a polypeptide having an amino acid sequence  
corresponding to SEQ ID NO:90;

35 said vector being capable of directing expression of said  
mutant human interleukin-3 polypeptide.

53. A recombinant DNA vector according to Claim 51 wherein the promoter is AraBAD.

54. A recombinant DNA vector according to  
5 Claim 51 wherein the ribosome binding site is gl0-L.

55. A recombinant DNA vector according to Claim 51 wherein the signal peptide is a lamB signal peptide.  
10

56. A recombinant DNA vector according to Claim 51 wherein the signal peptide is the lamB signal peptide depicted in Figure 8.  
15

57. A recombinant DNA vector according to Claim 51 wherein the promoter is AraBAD and the ribosome binding site is gl0-L.

58. A recombinant DNA vector according to Claim 51 wherein the promoter is AraBAD, the ribosome binding site is gl0-L, and the signal peptide is a lamB signal peptide.  
20

59. A recombinant DNA vector according to Claim 51 wherein the promoter is AraBAD, the ribosome binding site is gl0-L, and the signal peptide is the lamB signal peptide depicted in Figure 8.  
25

60. A recombinant bacterial host which comprises the vector of Claim 51 wherein said host secretes a mutant human interleukin-3 polypeptide selected from the group consisting of  
30

a polypeptide having an amino acid sequence  
35 corresponding to SEQ ID NO:88;

a polypeptide having an amino acid sequence

corresponding to SEQ ID NO:89; and

a polypeptide having an amino acid sequence  
corresponding to SEQ ID NO:90.

5

61. A polypeptide of the formula

|    |   |   |     |
|----|---|---|-----|
|    | 1   | 5                                       | 10  |
|    | (Met) <sub>m</sub> -Ala                             | Pro Met Thr Gln Thr Thr Ser Leu Lys Thr |     |
| 10 | 15  | 20                                      |     |
|    | Ser Trp Val Asn Cys Ser Xaa Met Ile Asp Glu Ile Ile |   |     |
| 25 | 30  | 35                                      |     |
|    | Xaa His Leu Lys Xaa Pro Pro Xaa Pro Leu Leu Asp Xaa |   |     |
|    | 40  | 45                                      | 50  |
| 15 | Asn Asn Leu Asn Xaa Glu Asp Xaa Asp Ile Leu Met Glu |   |     |
|    | 55  | 60                                      |     |
|    | Xaa Asn Leu Arg Xaa Pro Asn Leu Xaa Xaa Phe Xaa Arg |   |     |
|    | 65  | 70                                      | 75  |
|    | Ala Val Lys Xaa Leu Xaa Asn Ala Ser Xaa Ile Glu Xaa |   |     |
| 20 | 80  | 85                                      |     |
|    | Ile Leu Xaa Asn Leu Xaa Pro Cys Leu Pro Xaa Ala Thr |   |     |
|    | 90  | 95                                      | 100 |
|    | Ala Ala Pro Xaa Arg His Pro Ile Xaa Ile Lys Xaa Gly |   |     |
|    | 105   | 110                                     | 115 |
| 25 | Asp Trp Xaa Glu Phe Arg Xaa Lys Leu Thr Phe Tyr Leu |   |     |
|    | 120   | 125                                     |     |
|    | Xaa Thr Leu Glu Xaa Ala Gln Xaa Gln Gln Thr Thr Leu |   |     |
|    | 130   |   |     |
|    | Ser Leu Ala Ile Phe [SEQ ID NO:129]                 |   |     |

30

wherein m is 0 or 1; Xaa at position 18 is Asn or Ile;  
Xaa at position 25 is Thr or His; Xaa at position 29 is  
Gln, Arg, or Val; Xaa at position 32 is Leu, Ala, or Asn;  
Xaa at position 37 is Phe, Pro, or Ser; Xaa at position  
42 is Glu, Ala, or Ser; Xaa at position 45 is Gln, Val,  
35 or Met; Xaa at position 51 is Asn or Arg; Xaa at position  
55 is Arg, Leu, or Thr; Xaa at position 59 is Glu or Leu;

Xaa at position 60 is Ala or Ser; Xaa at position 62 is Asn or Val; Xaa at position 67 is Ser, Asn, or His; Xaa at position 69 is Gln or Glu; Xaa at position 73 is Ala or Gly; Xaa at position 76 is Ser or Ala; Xaa at position 79 is Lys or Arg; Xaa at position 82 is Leu, Glu, or Val; Xaa at position 87 is Leu or Ser; Xaa at position 93 is Pro or Ser; Xaa at position 98 is His, Ile, or Thr; Xaa at position 101 is Asp or Ala; Xaa at position 105 is Asn or Glu; Xaa at position 109 is Arg or Glu; Xaa at position 116 is Lys or Val; Xaa at position 120 is Asn, Gln, or His; Xaa at position 123 is Ala or Glu; with the proviso that from four to twenty-seven of the amino acids designated by Xaa are different from the corresponding amino acids of native human interleukin-3 and wherein from 1 to 14 of amino acids 1 to 14 has been deleted from the N-terminus and/or from 1 to 15 of amino acids 119 to 133 has been deleted from the C-terminus of the polypeptide; or a polypeptide having substantially the same structure and substantially the same biological activity.

62. A method according to Claim 47 of producing a mutant human interleukin-3 polypeptide comprising the steps of:

(a) culturing a host cell containing a recombinant DNA sequence comprising vector DNA and a DNA having a nucleotide sequence corresponding to SEQ ID NO:160 and capable of expressing the encoded polypeptide under conditions permitting expression of the recombinant DNA; and

(b) harvesting the polypeptide from the culture.

63. A method according to Claim 47 of producing a mutant human interleukin-3 polypeptide comprising the steps of:

(a) culturing a host cell containing a recombinant DNA sequence comprising vector DNA and a DNA having a nucleotide sequence corresponding to SEQ ID NO:161 and capable of expressing the encoded polypeptide under conditions permitting expression of the recombinant DNA; and

(b) harvesting the polypeptide from the culture.

64. A host cell containing a recombinant DNA vector comprising vector DNA and a DNA sequence selected from the group consisting of:

a DNA having a nucleotide sequence corresponding to SEQ ID NO:160; and

a DNA having a nucleotide sequence corresponding to SEQ ID NO:161;

and capable of expressing the encoded polypeptide.

65. A polypeptide according to Claim 27 which is:

Met Ala Asn Cys Ser Ile Met Ile Asp Glu Ile Ile His His  
Leu  
Lys Arg Pro Pro Asn Pro Leu Leu Asp Pro Asn Asn Leu Asn  
Ser  
Glu Asp Met Asp Ile Leu Met Glu Arg Asn Leu Arg Thr Pro  
Asn  
Leu Leu Ala Phe Val Arg Ala Val Lys His Leu Glu Asn Ala  
Ser  
Gly Ile Glu Ala Ile Leu Arg Asn Leu Gln Pro Cys Leu Pro  
Ser  
Ala Thr Ala Ala Pro Ser Arg His Pro Ile Ile Ile Lys Ala  
Gly  
Asp Trp Gln Glu Phe Arg Glu Lys Leu Thr Phe Tyr Leu Val  
Thr

362 10078113 .021500

Leu Glu Gln Ala Gln Glu Gln Gln [SEQ ID NO:89].

|   |     |     |
|---|-----|-----|
| 1   | 5   | 10  |
| ATG GCT CCA ATG ACT CAG ACT ACT TCT CTT AAG ACT TCT |     |     |
| Met Ala Pro Met Thr Gln Thr Thr Ser Leu Lys Thr Ser |     |     |
| 15  | 20  | 25  |
| TGG GTT AAC TGC TCT AAC ATG ATC GAT GAA ATT ATA ACA |     |     |
| Trp Val Asn Cys Ser Asn Met Ile Asp Glu Ile Ile Thr |     |     |
| 30  | 35  |     |
| CAC TTA AAG CAG CCA CCT TTG CCT TTG CTG GAC TTC AAC |     |     |
| His Leu Lys Gln Pro Pro Leu Pro Leu Leu Asp Phe Asn |     |     |
| 40  | 45  | 50  |
| AAC CTC AAT GGG GAA GAC CAA GAC ATT CTG ATG GAA AAT |     |     |
| Asn Leu Asn Gly Glu Asp Gln Asp Ile Leu Met Glu Asn |     |     |
| 55  | 60  |     |
| AAC CTT CGA AGG CCA AAC CTG GAG GCA TTC AAC AGG GCT |     |     |
| Asn Leu Arg Arg Pro Asn Leu Glu Ala Phe Asn Arg Ala |     |     |
| 65  | 70  | 75  |
| GTC AAG AGT TTA CAG AAT GCA TCA GCA ATT GAG AGC ATT |     |     |
| Val Lys Ser Leu Gln Asn Ala Ser Ala Ile Glu Ser Ile |     |     |
| 80  | 85  | 90  |
| CTT AAA AAT CTC CTG CCA TGT CTG CCC CTG GCC ACG GCC |     |     |
| Leu Lys Asn Leu Leu Pro Cys Leu Pro Leu Ala Thr Ala |     |     |
| 95  | 100 |     |
| GCA CCC ACG CGA CAT CCA ATC CAT ATC AAG GAC GGT GAC |     |     |
| Ala Pro Thr Arg His Pro Ile His Ile Lys Asp Gly Asp |     |     |
| 105   | 110 | 115 |
| TGG AAT GAA TTC CGT CGT AAA CTG ACC TTC TAT CTG AAA |     |     |
| Trp Asn Glu Phe Arg Arg Lys Leu Thr Phe Tyr Leu Lys |     |     |
| 120   | 125 |     |
| ACC TTG GAG AAC GCG CAG GCT CAA CAG ACC ACT CTG TCG |     |     |
| Thr Leu Glu Asn Ala Gln Ala Gln Gln Thr Thr Leu Ser |     |     |
| 130   |     |     |
| CTA GCG ATC TTT TAA TAA [SEQ ID NO:144]             |     |     |
| Leu Ala Ile Phe END END [SEQ ID NO:128]             |     |     |

FIG. 1

C  
 l  
 a  
 I  
  
 aa20 ATCGATGAAATCATCACCACCTGAAGCAGCCACCGCTGCCGCTGCTGGACTTCAACAAC  
 1 -----+-----+-----+-----+-----+-----+ 60  
 IleAspGluIleIleThrHisLeuLysGlnProProLeuProLeuLeuAspPheAsnAsn -  
  
 E X  
 C h  
 o o  
 R I  
 V  
  
 61 CTCAATGGTGAAGACCAAGATATCCTGATGGAAATAACCTTCGTCGTCCAAACCTCGAG  
 -----+-----+-----+-----+-----+-----+ 120  
 LeuAsnGlyGluAspGlnAspIleLeuMetGluAsnAsnLeuArgArgProAsnLeuGlu -  
  
 P N  
 s s  
 t i  
 I I  
  
 121 GCATTCAACCGTGTCAAGTCTCTGCAGAAATGCAT [SEQ ID NO:145] aa70  
 -----+-----+-----+-----+-----+ 157  
 AlaPheAsnArgAlaValLysSerLeuGlnAsnAla [SEQ ID NO:146]

FIG. 2: Clal to NsiI Replacement Fragment

FIG. 2



N  
 C  
 O  
 I  
 H  
 P  
 a  
 I  
 1 CCATGGCTCCAATGACTCAGACTACTTCTCTTAAGACTTCTTGGGTAACTGCTCTAACA 60  
 -----+-----+-----+-----+-----+-----+-----+ 60  
 GGTACCGAGGTTACTGAGTCTGATGAAGAGAATTCTGAAGAACCCAATTGACGAGATTGT  
 MetAlaProMetThrGlnThrThrSerLeuLysThrSerTrpValAsnCysSerAsnMet  
 C  
 l  
 a  
 I  
 61 TGATCGATGAAATTATAACACACTTAAAGCAGCCACCTTTGCCTTTGCTGGACTTCAACA 120  
 -----+-----+-----+-----+-----+-----+ 120  
 ACTAGCTACTTTAATATTGTGTGAATTCGTCGGTGGAACGGAAACGACCTGAAGTTGT  
 IleAspGluIleIleThrHisLeuLysGlnProProLeuProLeuLeuAspPheAsnAsn  
 121 ACCTCAATGGGGAAGACCAAGACATTCTGATGGAAAATAACCTTCGAAGGCCAAACCTGG 180  
 -----+-----+-----+-----+-----+-----+ 180  
 TGGAGTTACCCCTTCTGGTTCTGTAAGACTACCTTTTATTGGAAGCTTCCGGTTTGGACC  
 LeuAsnGlyGluAspGlnAspIleLeuMetGluAsnAsnLeuArgArgProAsnLeuGlu  
 N  
 S  
 i  
 I  
 181 AGGCATTCAACAGGGCTGTCAAGAGTTTACAGAATGCATCAGCAATTGAGAGCATTCTTA 240  
 -----+-----+-----+-----+-----+-----+ 240  
 TCCGTAAGTTGTCCCGACAGTTCTCAAATGTCTTACGTAGTCGTAACTCTCGTAAGAAT  
 AlaPheAsnArgAlaValLysSerLeuGlnAsnAlaSerAlaIleGluSerIleLeuLys  
 241 AAAATCTCCTGCCATGTCTGCCCCTGGCCACGGCCGCACCCACGCGACATCCAATCCATA 300  
 -----+-----+-----+-----+-----+-----+ 300  
 TTTTAGAGGACGGTACAGACGGGGACCGGTGCCGGCGTGGGTGCGCTGTAGGTTAGGTAT  
 AsnLeuLeuProCysLeuProLeuAlaThrAlaAlaProThrArgHisProIleHisIle

FIG. 3A

E  
C  
O  
R  
I

301 TCAAGGACGGTGACTGGAATGAATTCCGTCGTAACTGACCTTCTATCTGAAAACCTTGG 360  
-----+-----+-----+-----+-----+-----+  
AGTTCCTGCCACTGACCTTACTTAAGGCAGCATTTGACTGGAAGATAGACTTTTGGAACC

LysAspGlyAspTrpAsnGluPheArgArgLysLeuThrPheTyrLeuLysThrLeuGlu

H  
i  
n  
d  
I  
I  
I

N  
h  
e  
I

361 AGAACGCGCAGGCTCAACAGACCACTCTGTCGCTAGCGATCTTTTAATAAGCTT 414  
-----+-----+-----+-----+-----+-----+  
TCTTGCGCGTCCGAGTTGTCTGGTGAGACAGCGATCGCTAGAAAATTATTCGAA

AsnAlaGlnAlaGlnGlnThrThrLeuSerLeuAlaIlePheEndEnd

FIG. 3B

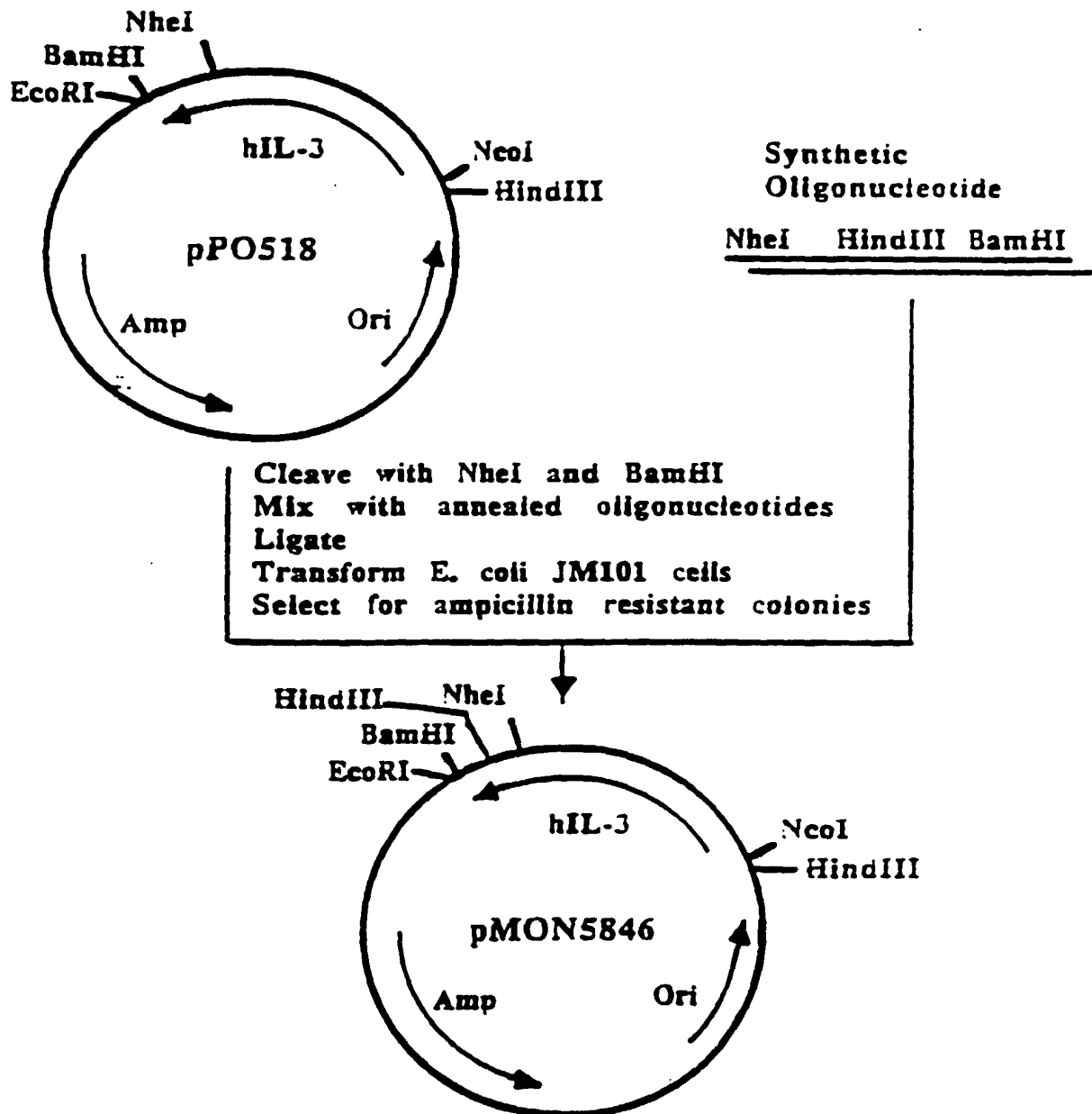


FIG. 4

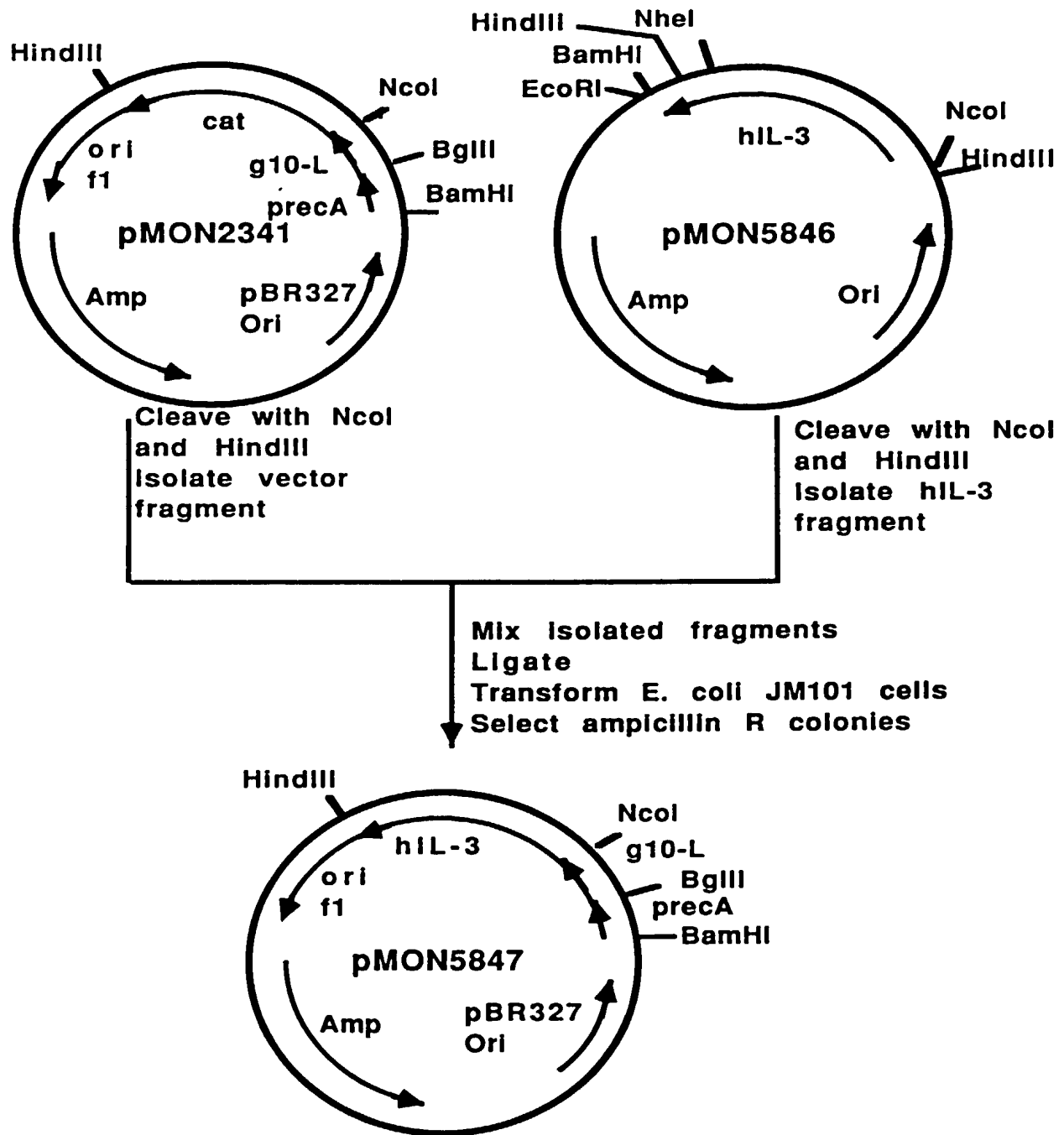


FIG. 5

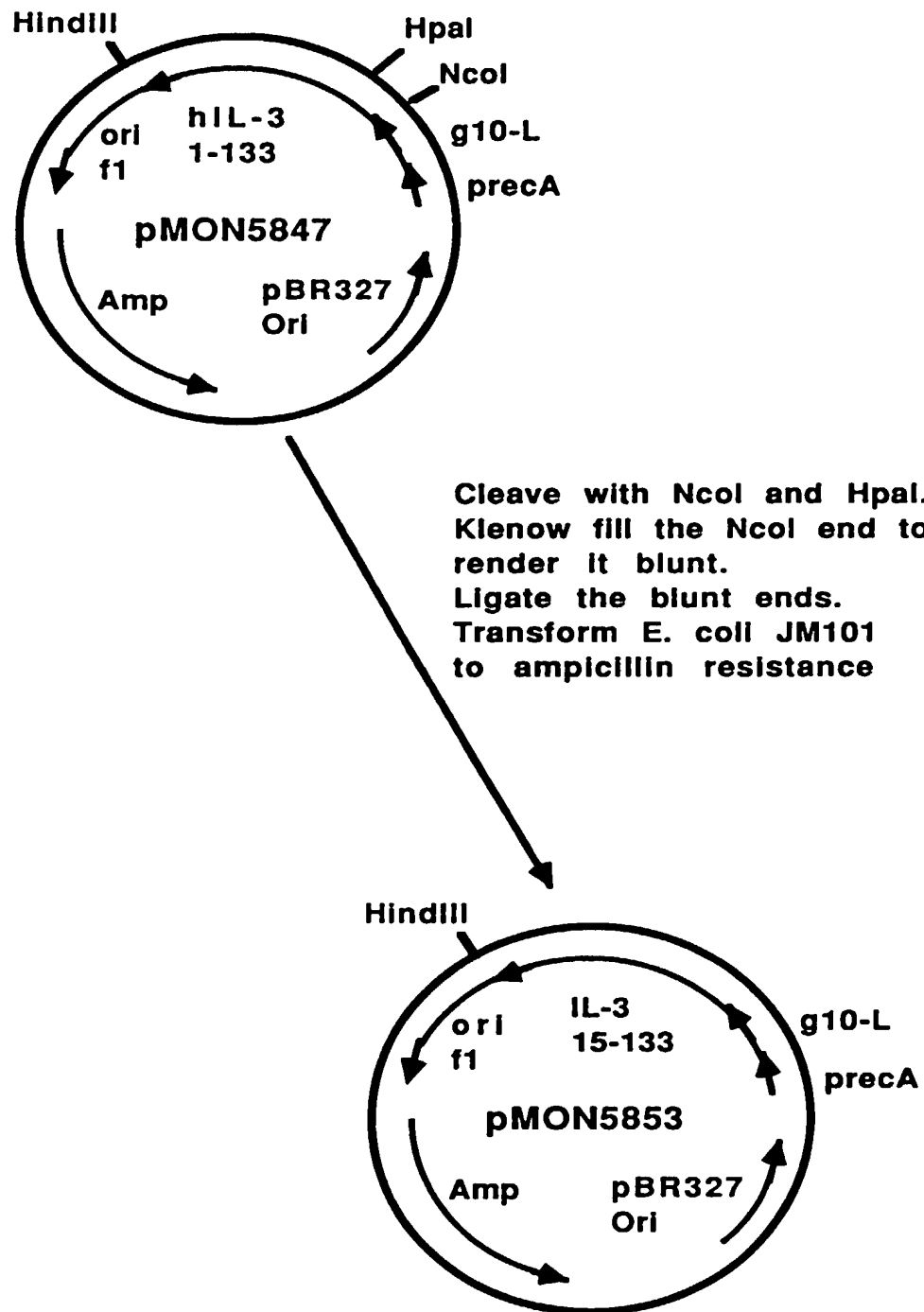


FIG. 6

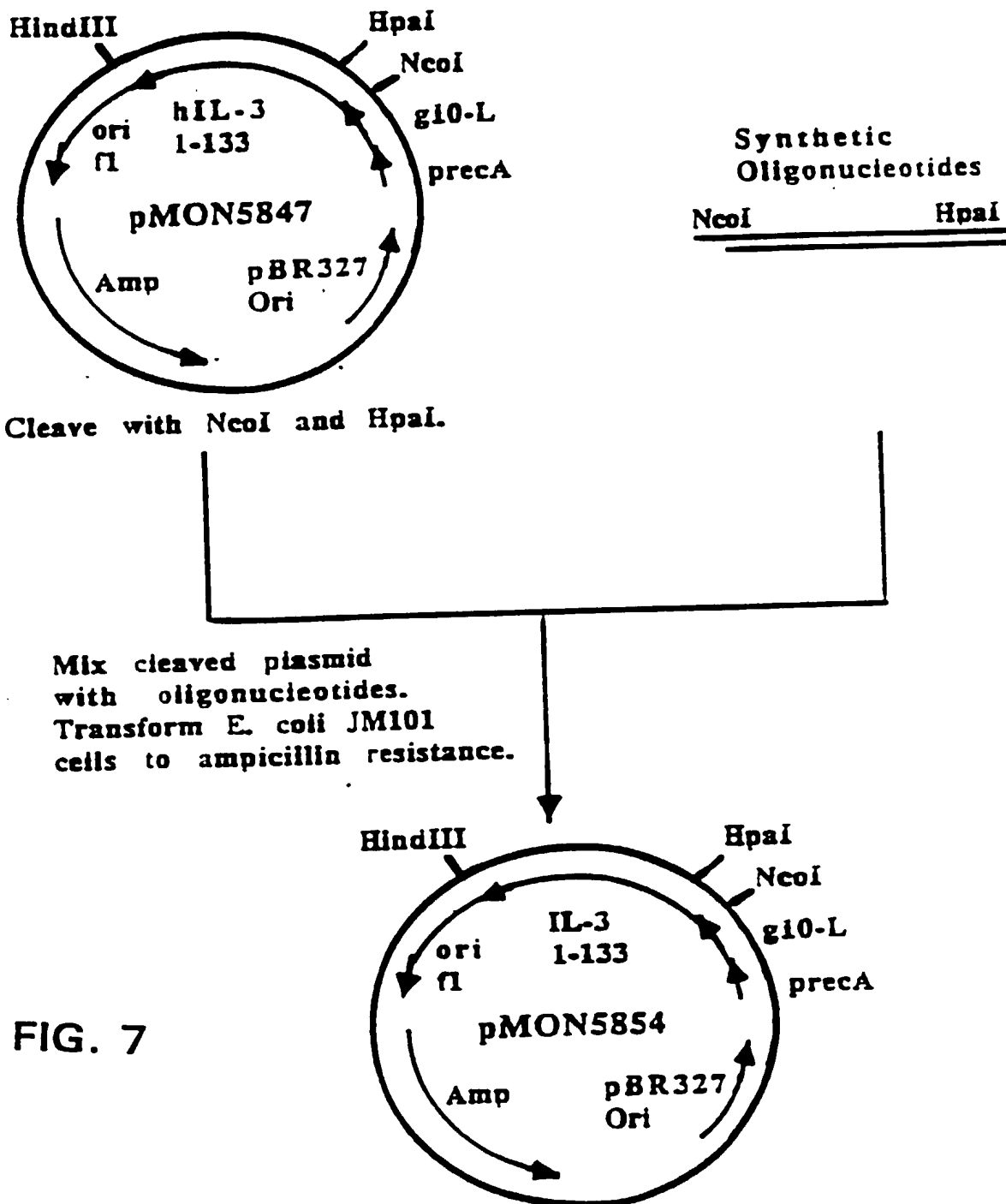


FIG. 7

1 ATGATGATTACTCTGCGCAAACCTCCTCTGGCGGTTGCCGTCGCAGCGGGCGTAATGTCT 60  
 -----+-----+-----+-----+-----+  
 TACTACTAATGAGACGCGTTTGAAGGAGACCGCCAACGGCAGCGTCGCCCCGATTACAGA  
 MetMetIleThrLeuArgLysLeuProLeuAlaValAlaValAlaAlaGlyValMetSer  
  
 N  
 C  
 O  
 I  
 61 GCTCAGGCCCATGGCTAACTGC [SEQ ID NO: 149]  
 -----+-----+-----+-----+-----+ 81  
 CGAGTCCGGTACCGATTGACG [SEQ ID NO: 150]  
 AlaGlnAlaMetAlaAsnCys [SEQ ID NO: 14]  
 ↑

lamB Signal Peptide

FIG. 8

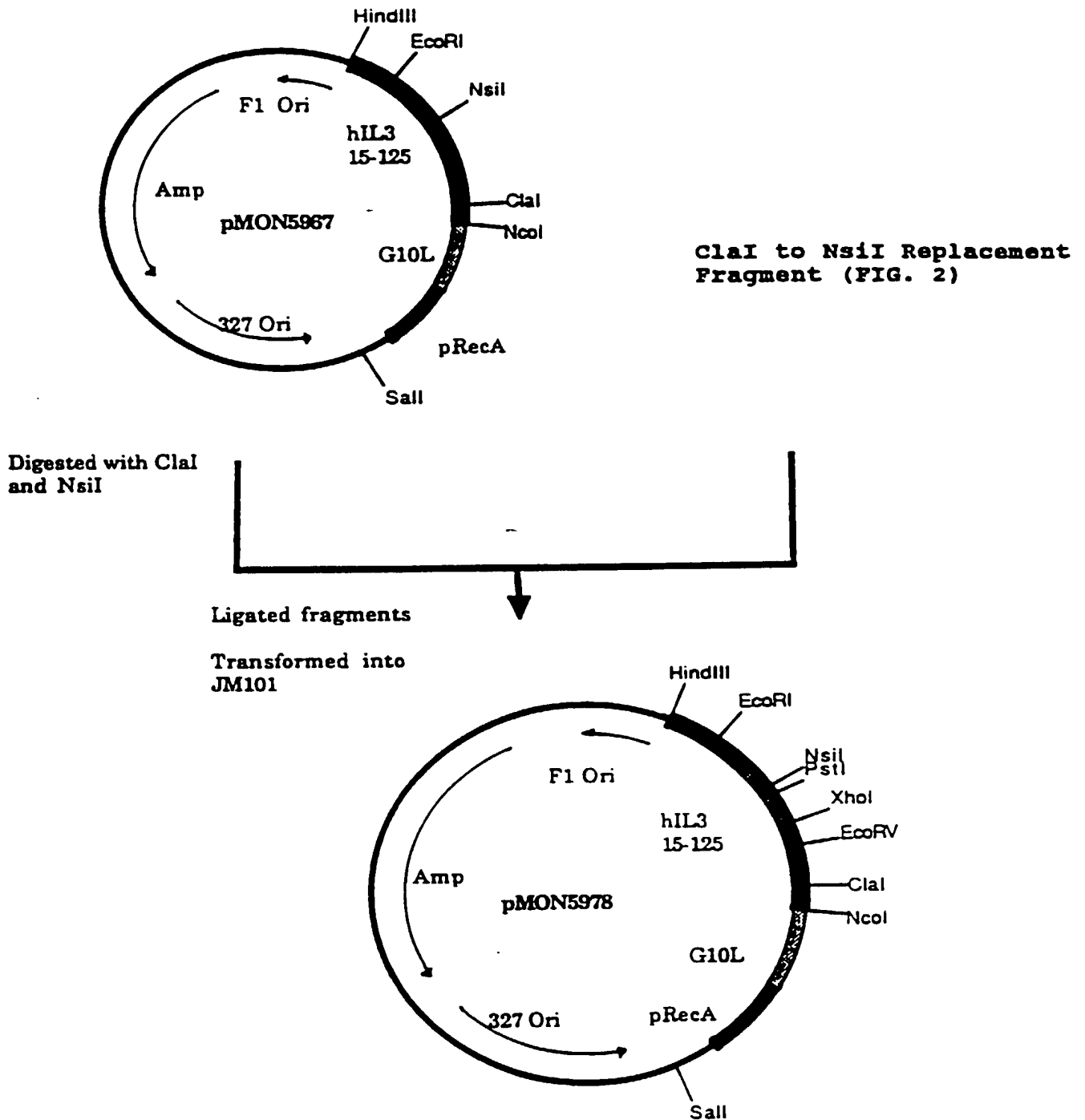


FIG. 9



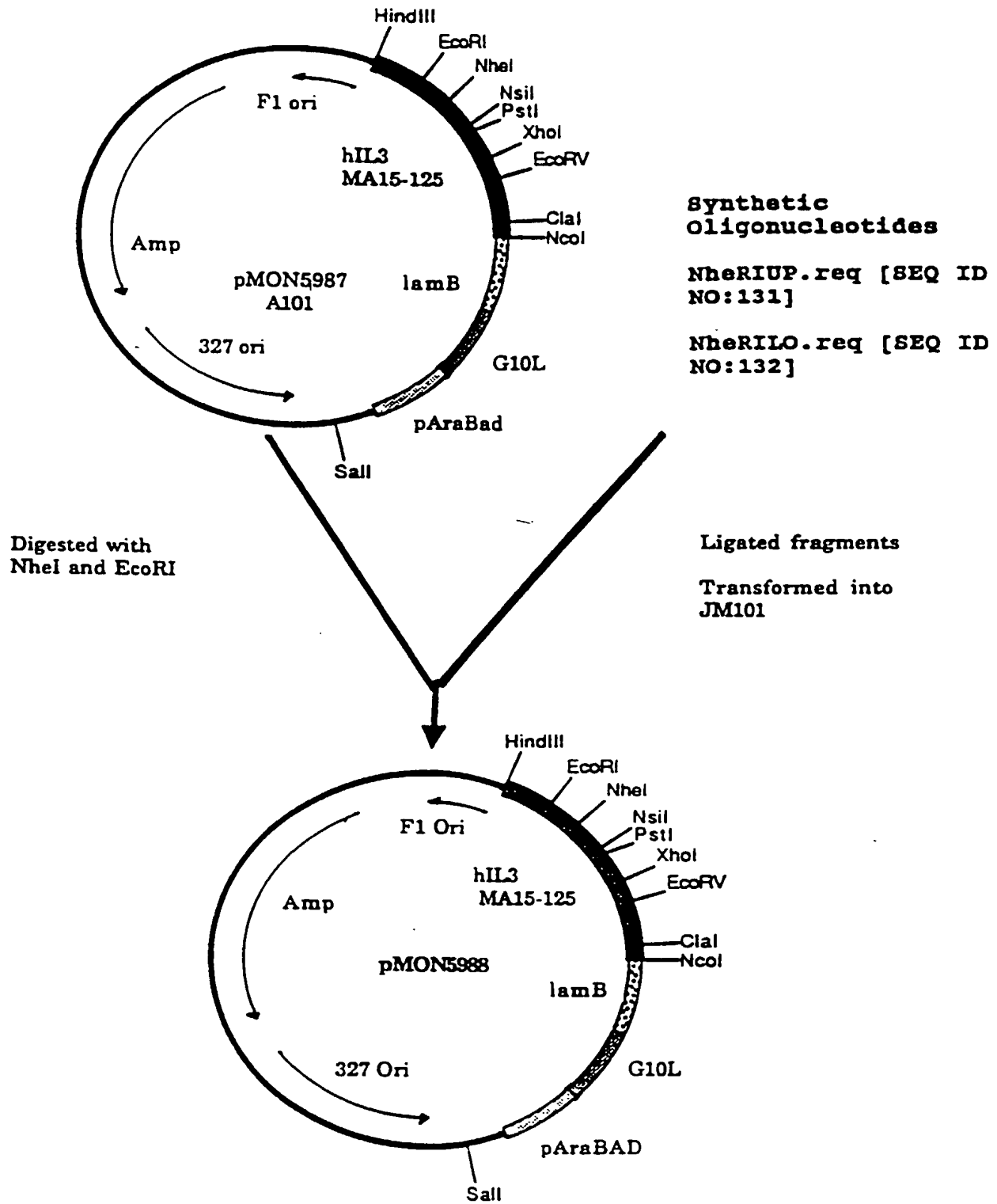


FIG 10

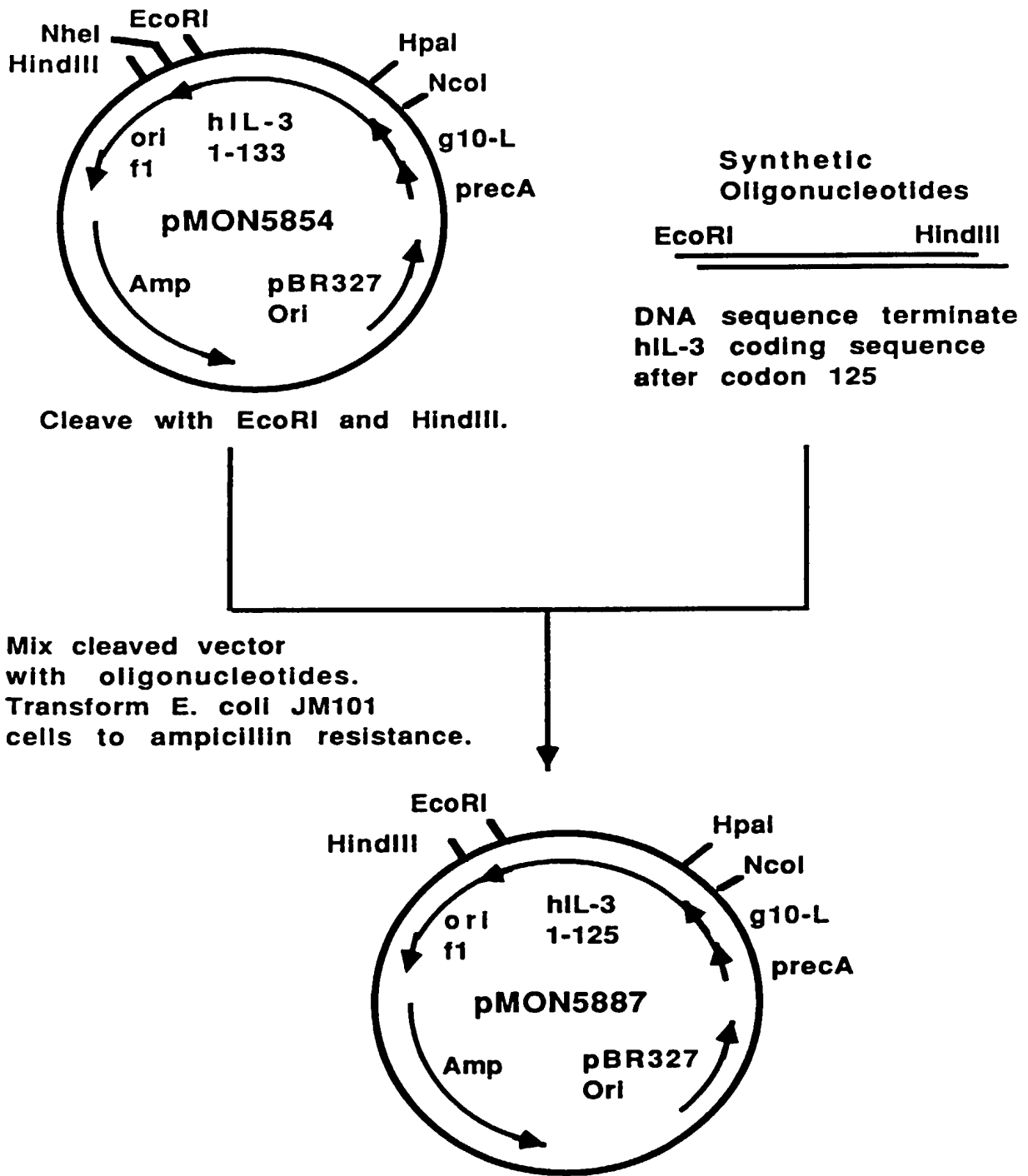


FIG. 11

5' CATGGCTAACTGCTCTAACATGAT 3'  
SEQ ID NO:151

3' CGATTGACGAGATTGTACTAGC 5'  
SEQ ID NO:152

Annealed  
oligonucleotides

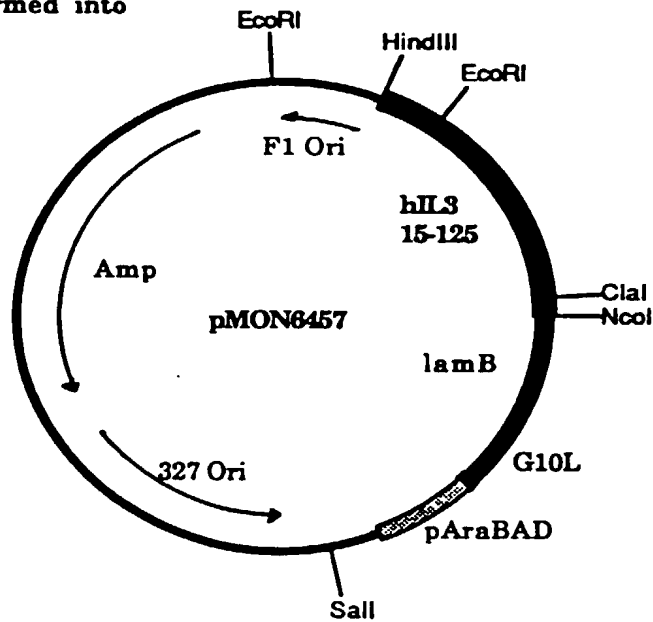
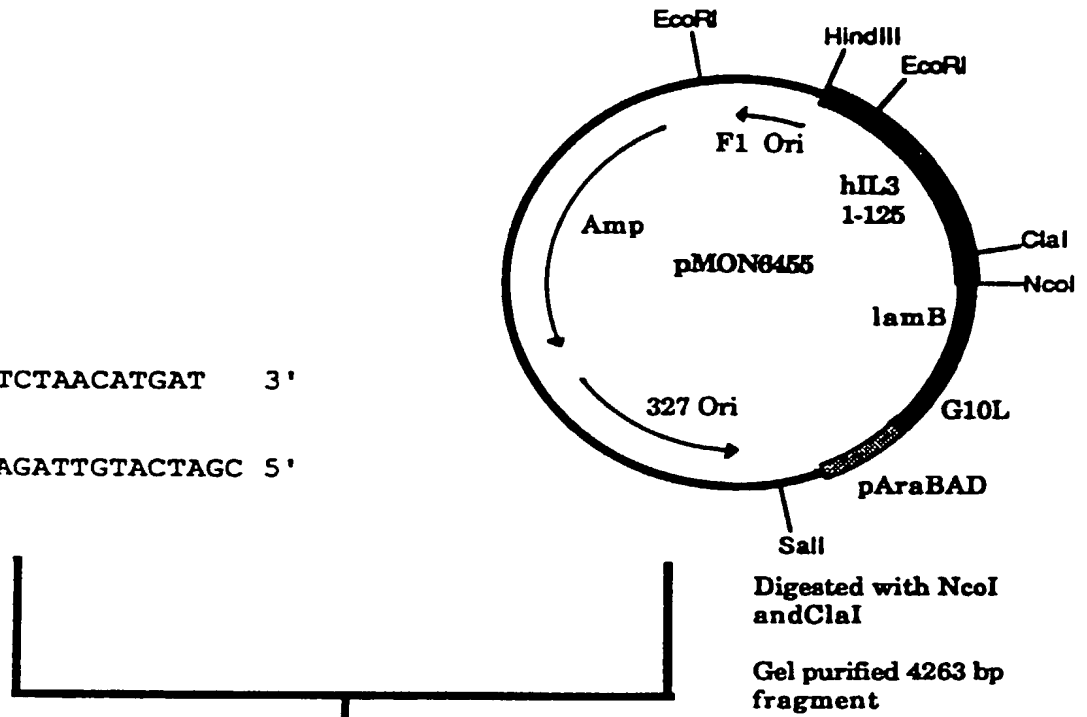
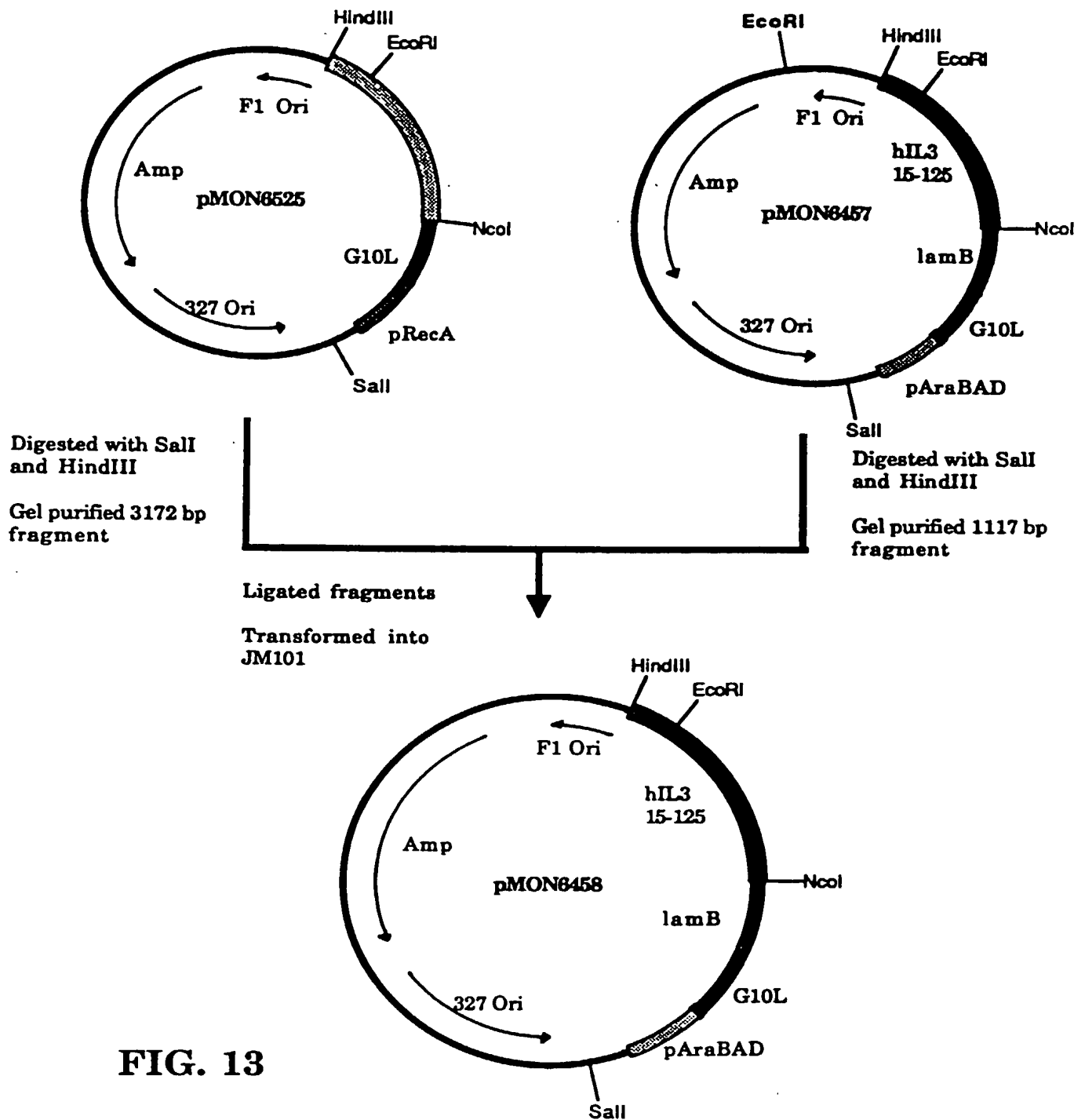


FIG. 12

**FIG. 13**

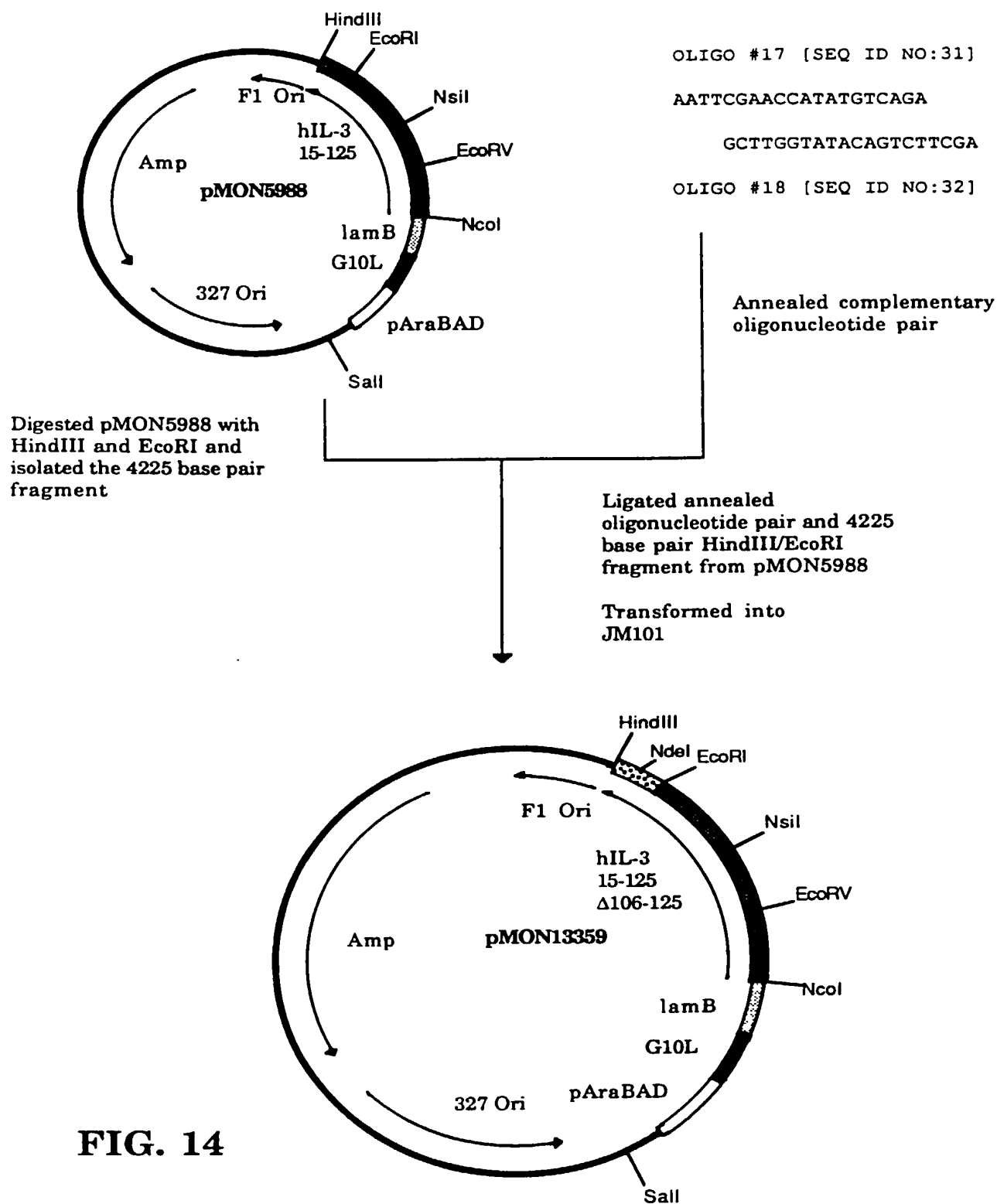


FIG. 14

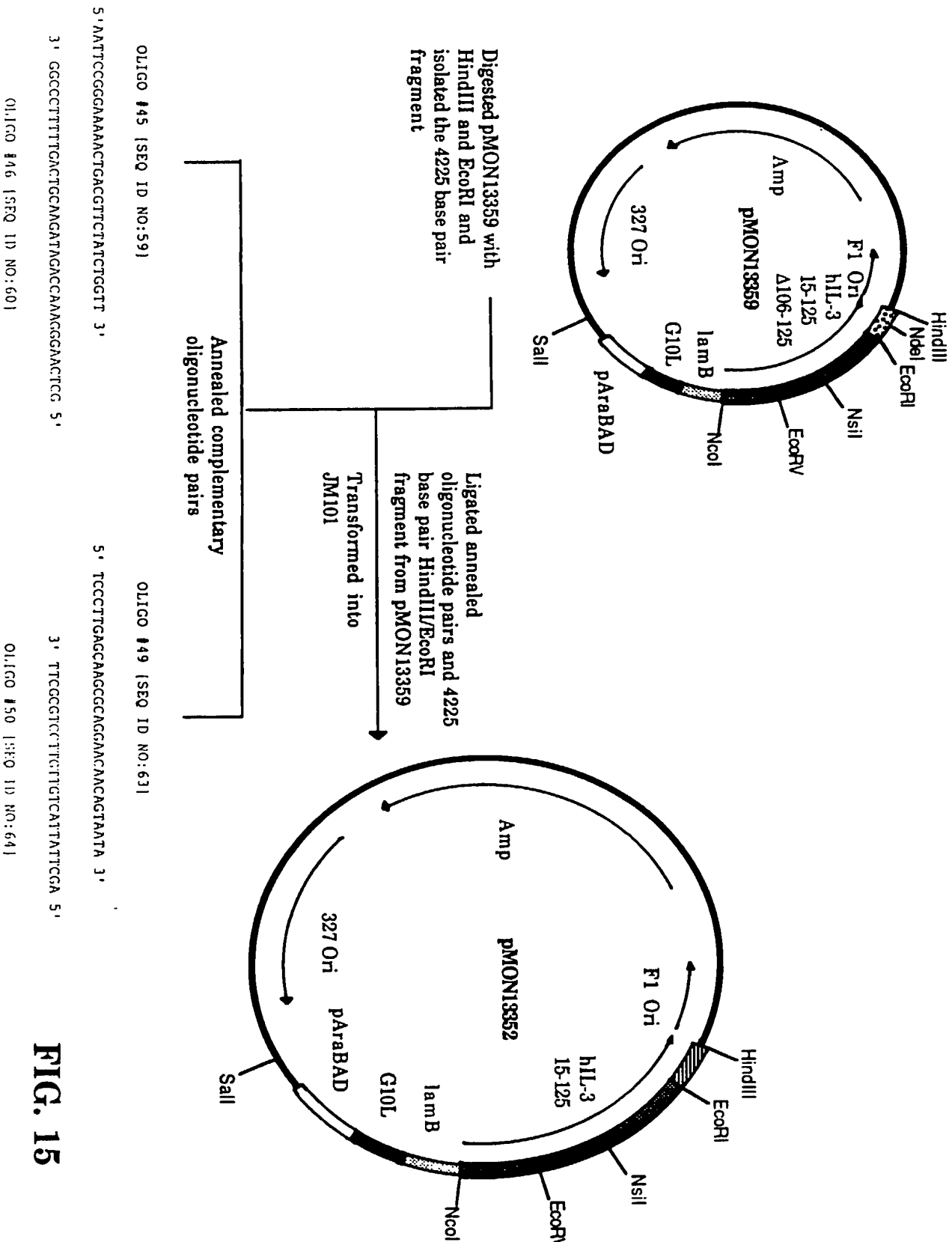


FIG. 15

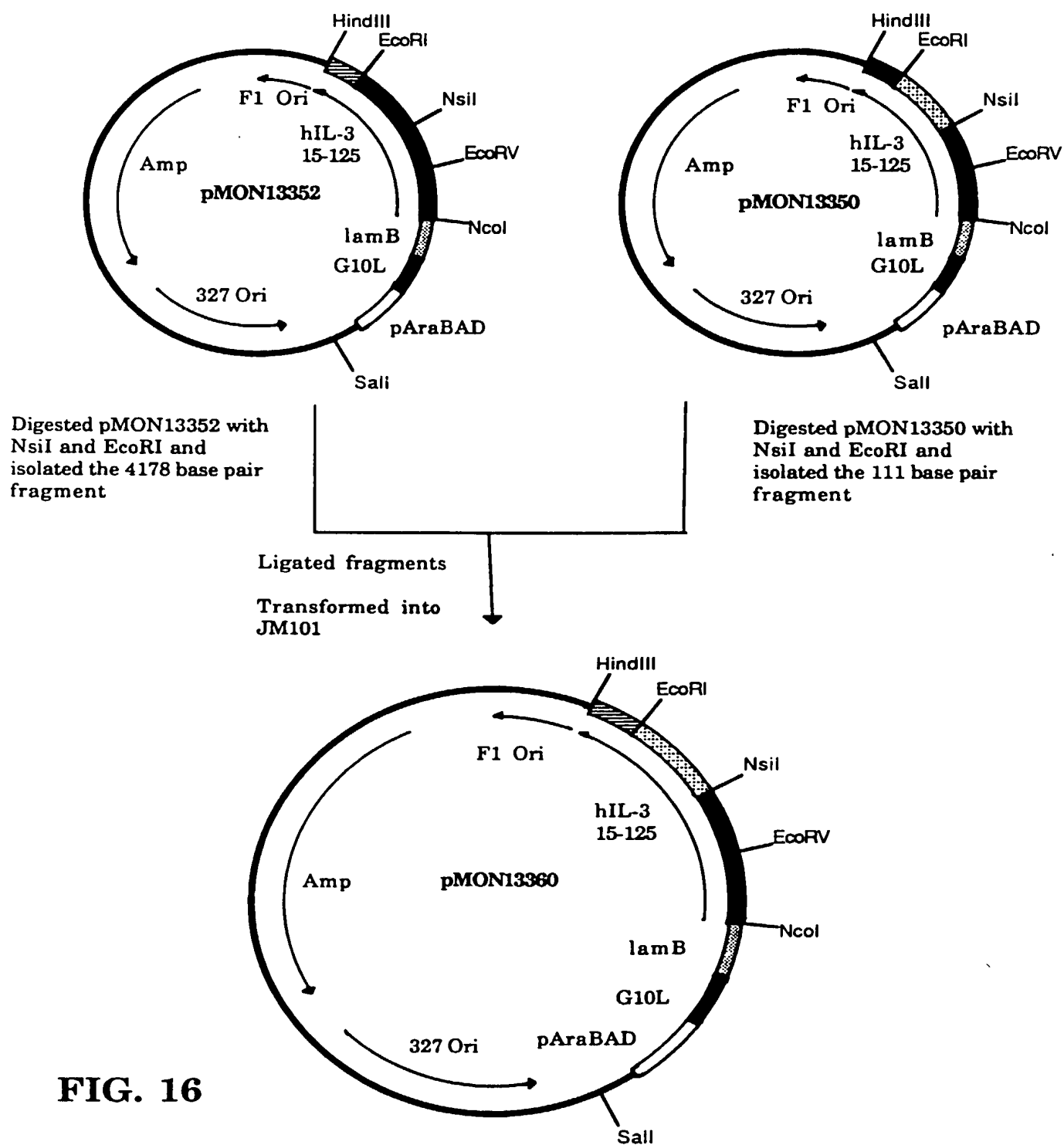
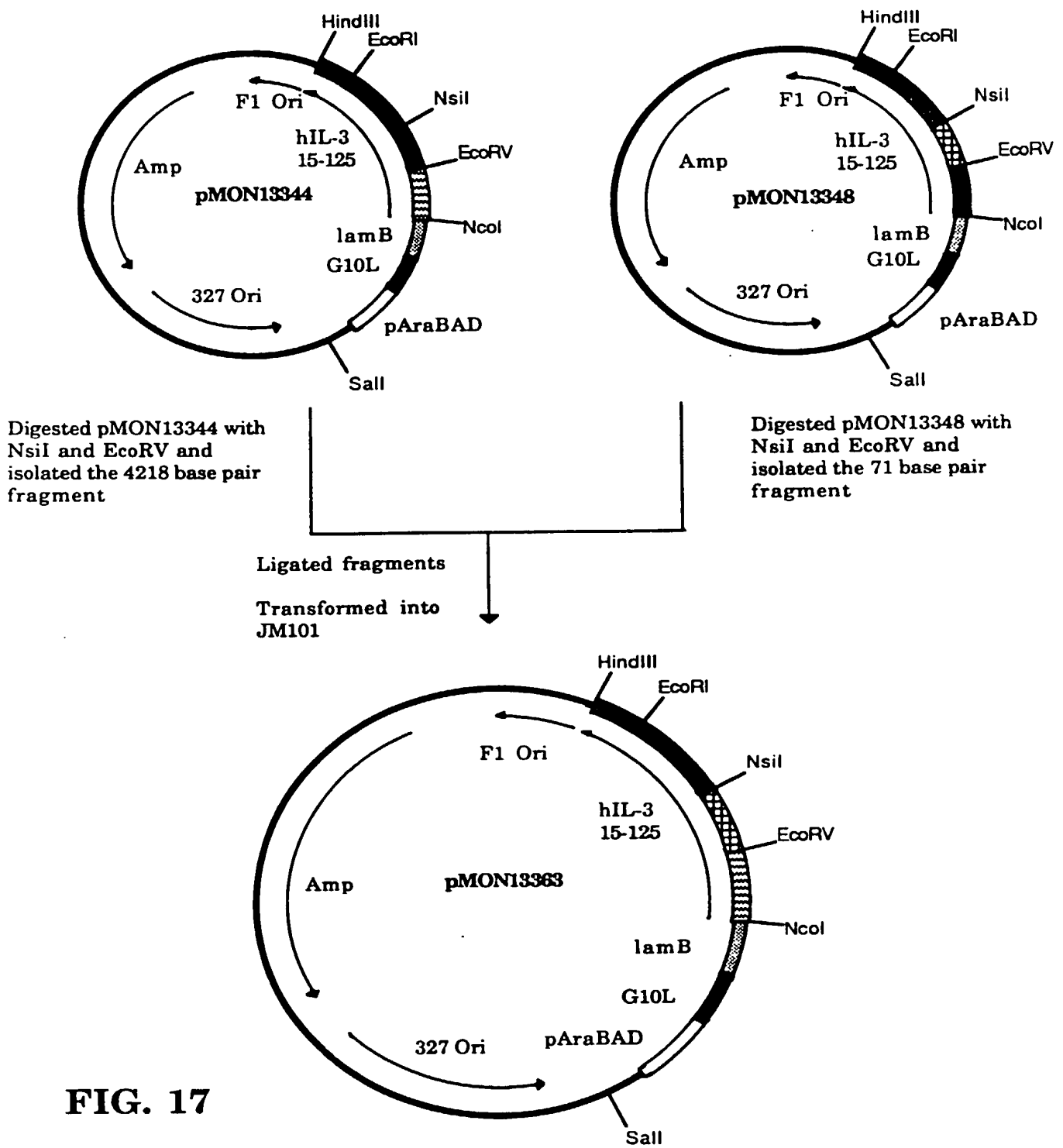
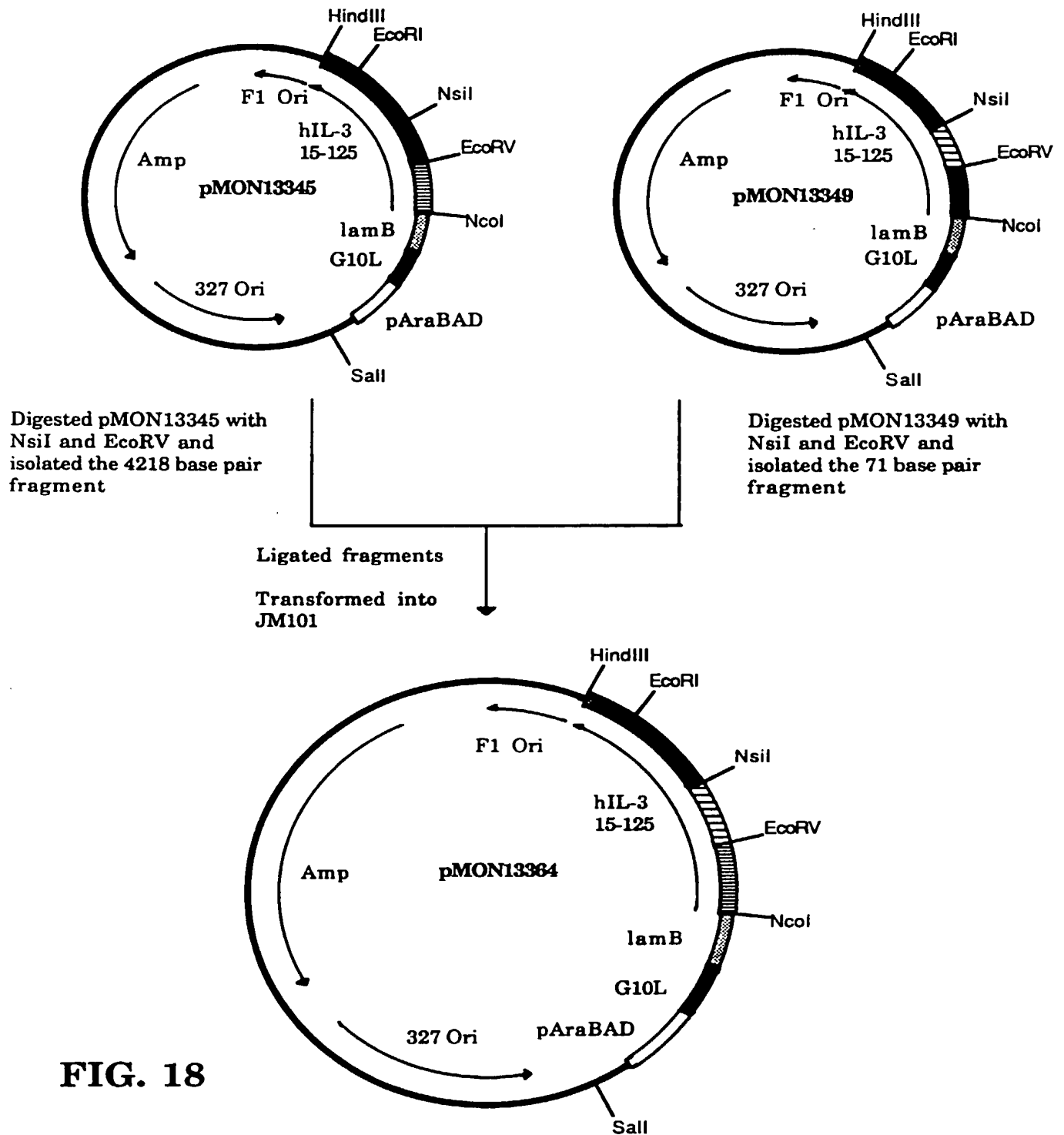
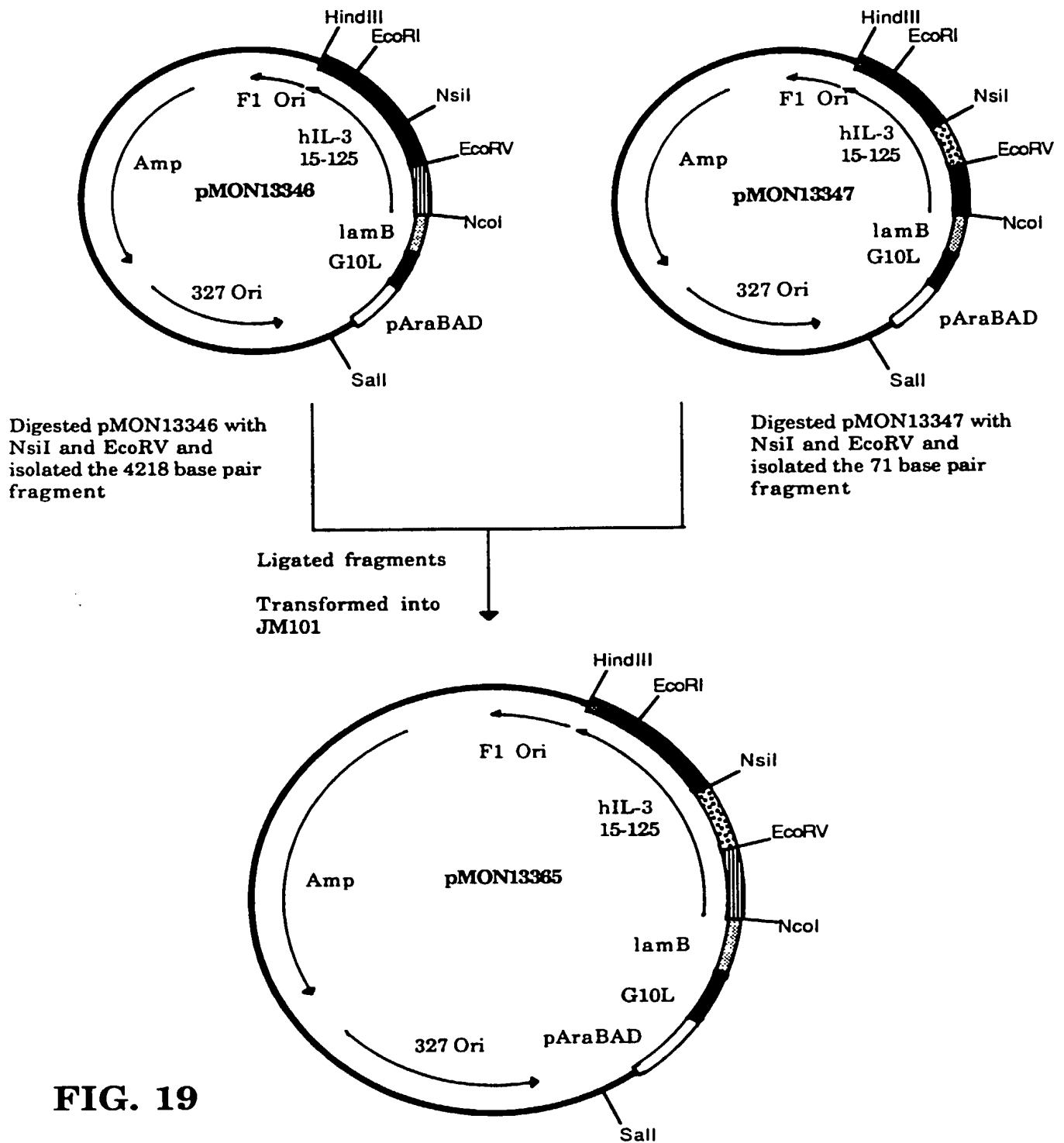


FIG. 16

**FIG. 17**





**FIG. 19**

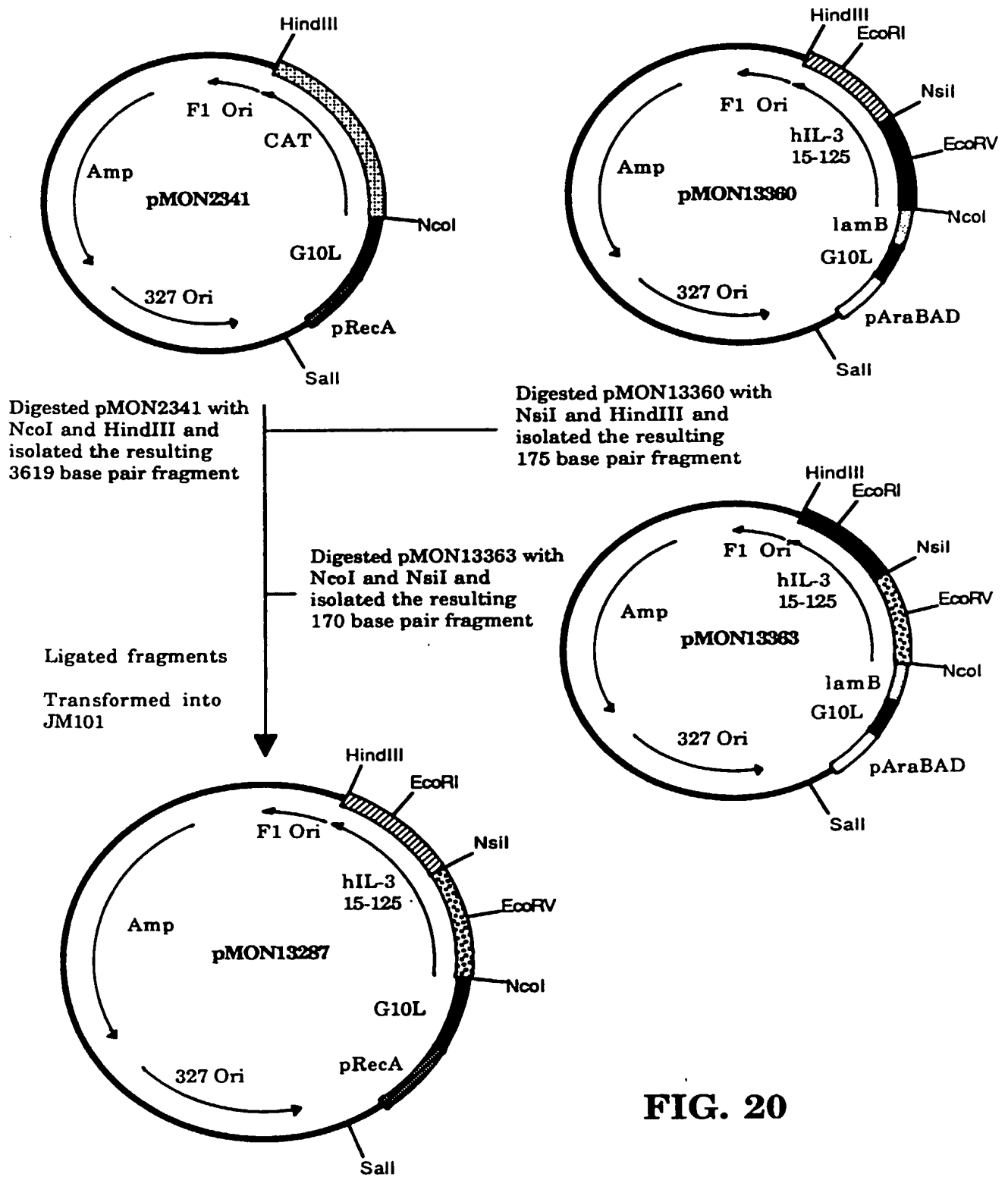
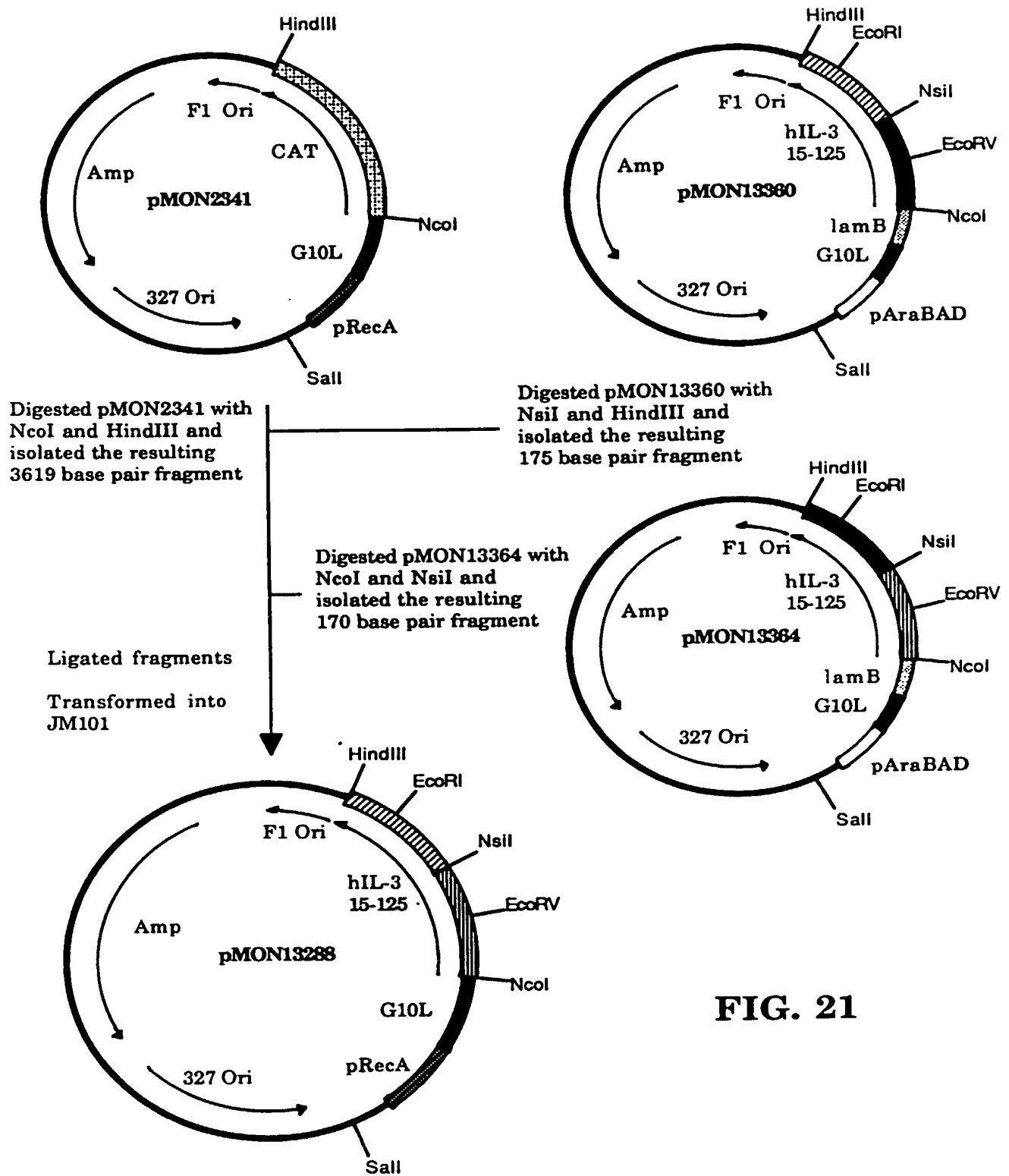
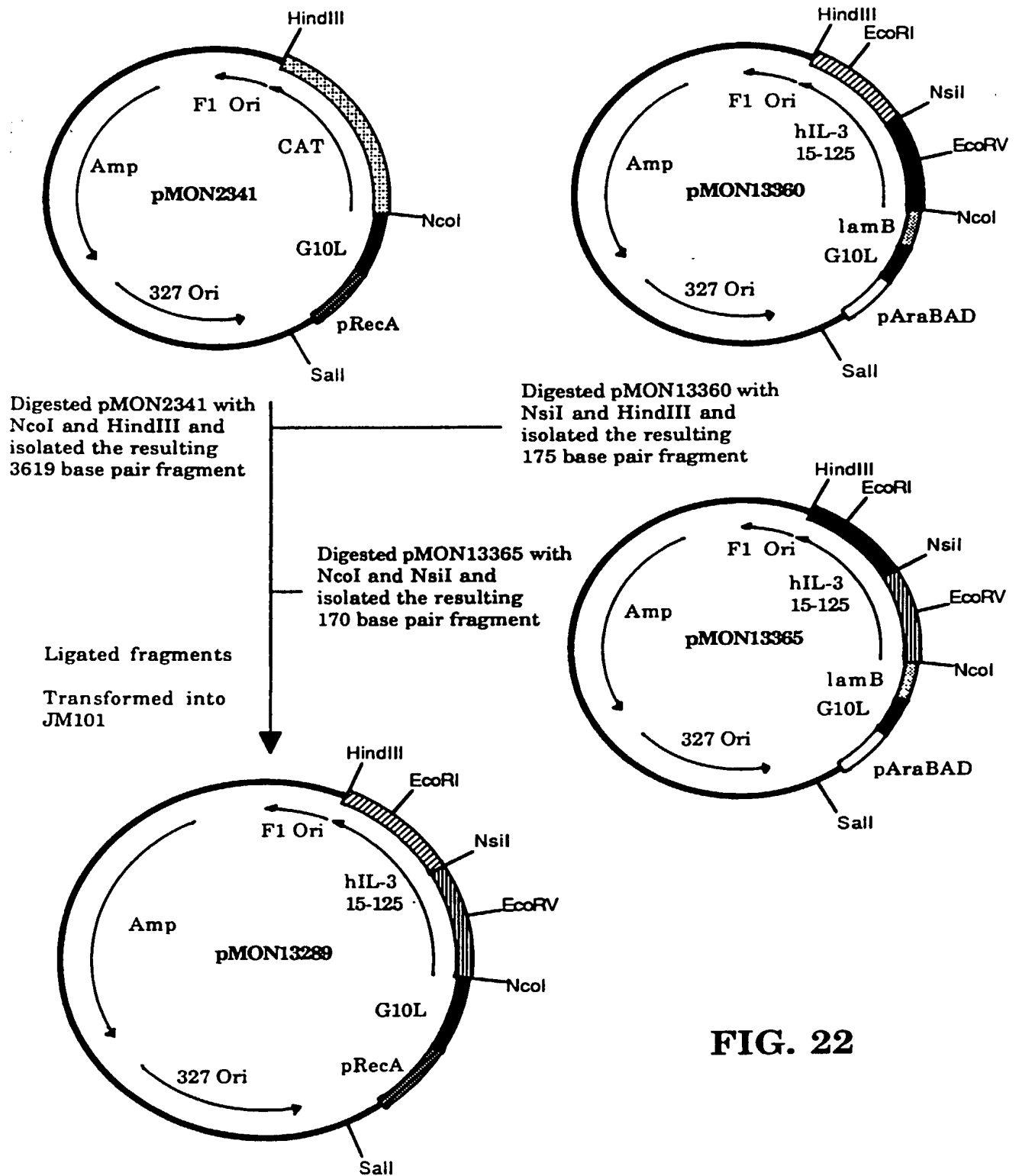


FIG. 20



**FIG. 21**

**FIG. 22**

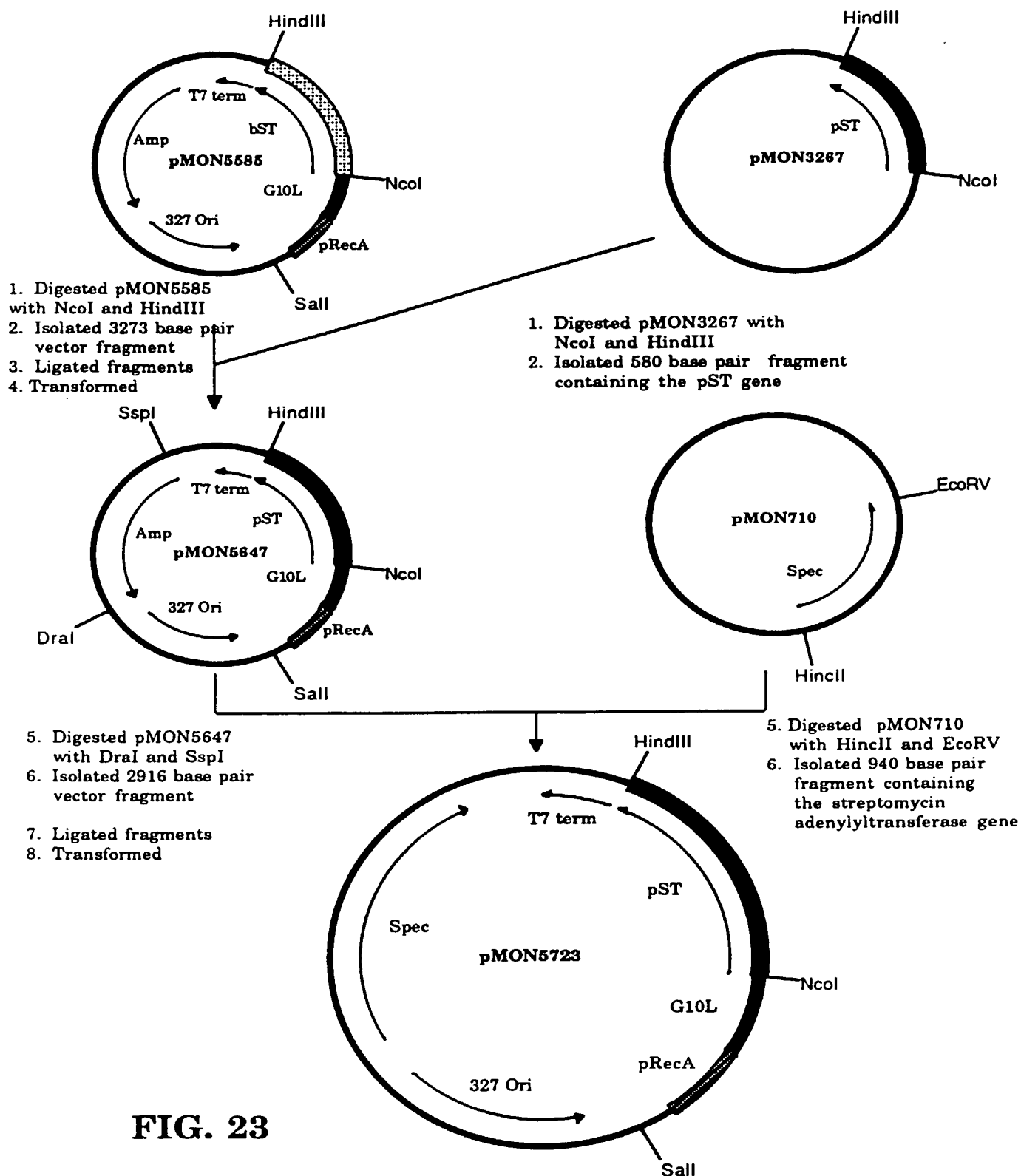


FIG. 23

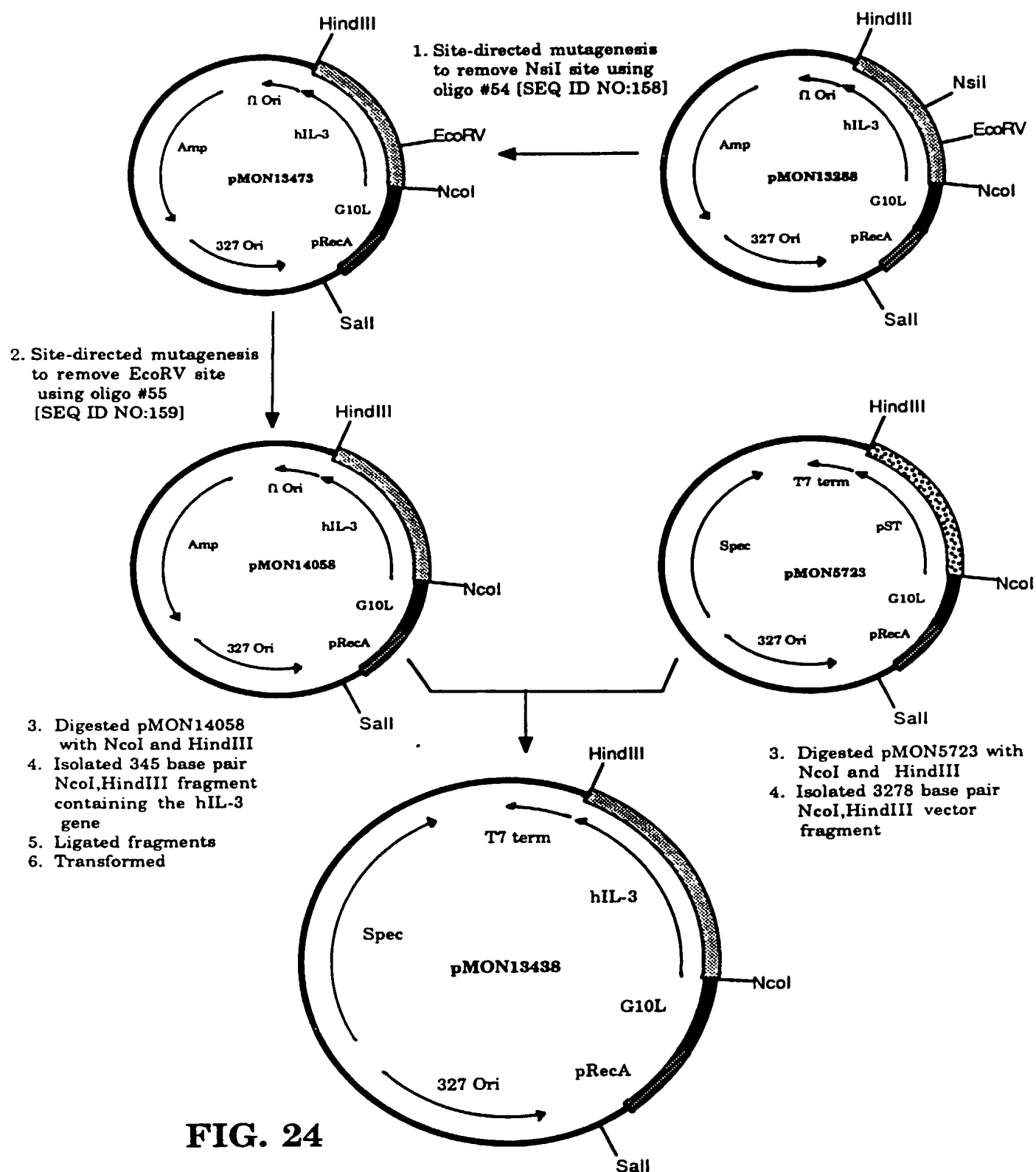


FIG. 24